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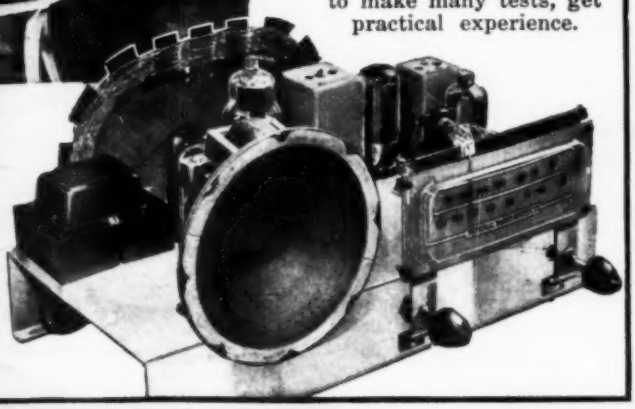

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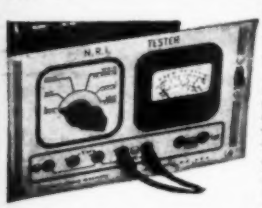

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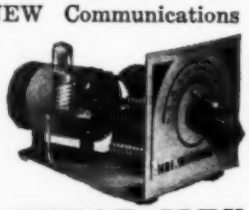

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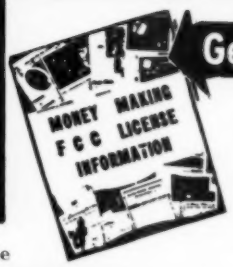

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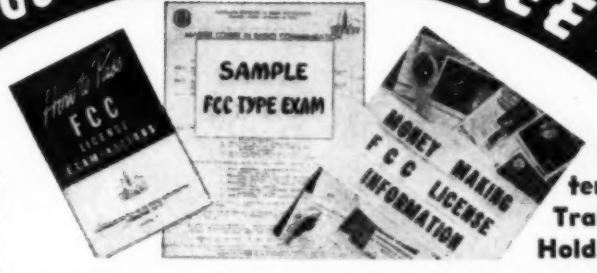

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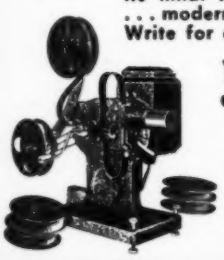

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For the RECORD

BY THE EDITOR

CITIZENS' RADIO NOT FOR EXPERIMENTERS

OUR daily mail bag seldom fails to include several letters asking how to build transmitters and receivers for the new Citizens' Radio Service. To answer this common question we quote in part from a recent FCC release:

"In this connection, it should be remembered that the regular Citizens' Radio Service is a fixed and mobile service intended for use for private or personal radiocommunication, radio signalling, control of objects or devices by radio, and other purposes not specifically prohibited in the Citizens' rules.

"The Commission has concluded that there is no simple method existing at this time for compliance with the technical standards of the Citizens' Radio Service by home constructors or experimenters, and that highly specialized engineering experience in ultra high frequency techniques is required in the design of equipment to be used in the regular Citizens' Radio Service. Manufacturers and individuals interested solely in the development and testing of equipment for this service should consider the submission of application for Class 1 experimental station authorizations.

"An applicant proposing to use equipment which has not been 'type approved' by the Commission must supply certain additional technical information in conjunction with his application for a Citizens' Radio Construction Permit and License, in order that the Commission may determine the technical acceptability of the equipment for operation in the Citizens' Radio Service.

"In the compilation of this technical information, the applicant is required to describe in full the design and construction of his transmitter and the methods employed in testing it for compliance with applicable Citizens' Radio rules. He should also explain in detail how his equipment will, under normal operating conditions, comply with the Citizens' Radio Service rules. A circuit diagram of the transmitter and a list of the technical components should also be submitted. In certain cases, the Commission may require that non-type-approved equipment be shipped to its laboratory at Laurel, Maryland, for test when it cannot be determined from technical data submitted by the applicant that the standards will be met.

"As noted above, tests conducted by the Commission's laboratory and information received from other sources indicate that the problem of constructing or modifying equipment that will operate satisfactorily in the frequency band 460-470 mc., *within the technical requirements prescribed in the Citizens' Radio Service rules*, requires the most careful engineering. In addition, the use of auxiliary equipment for the measurement of frequency, voltages and currents, width of communication band, and percentage of modulation as well as spurious and harmonic radiations is involved in connection with the design, modification and testing of Citizens' Radio equipment, and unless such apparatus is available for the purpose of checking the transmitters, the possibility of compliance with the technical requirements of the rules may be remote. In the technical showing described hereinabove, the applicant should specify the measuring equipment used in conducting all tests, giving the type number, manufacturer's name and per-cent of accuracy of such devices.

"For example, war-surplus equipment, such as the BC-645 transmitter-receiver, designed for airborne use, does not possess in its original form sufficiently stable circuits to permit licensing in the Citizens' Radio Service. Extensive modification, in some cases amounting to almost complete redesign of the original equipment, appears to be necessary to meet the standards of the Citizens' Radio Service rules and will be required before the Commission will consider authorizing the use of the majority of war-surplus apparatus in the Citizens' Radio Service.

"In this connection, Commission laboratory tests involving BC-645 transponders, converted for operation in the 460-470 mc. frequency band, demonstrated the instability of this equipment. The particular sets tested did not meet the technical requirements of the Citizens' Radio Service rules. Inasmuch as a large number of outstanding Experimental Licenses for Class 2 operation in the Citizens' Radio Band specify the use of converted BC-645 transmitters, it is expected that upon the expiration of these experimental grants November 1, 1949, careful scrutiny will be made of applications to relicense this equipment in the regular Citizens' Radio Service."

It is quite clear that technical requirements for the CRS are quite severe and beyond the scope of most technicians.

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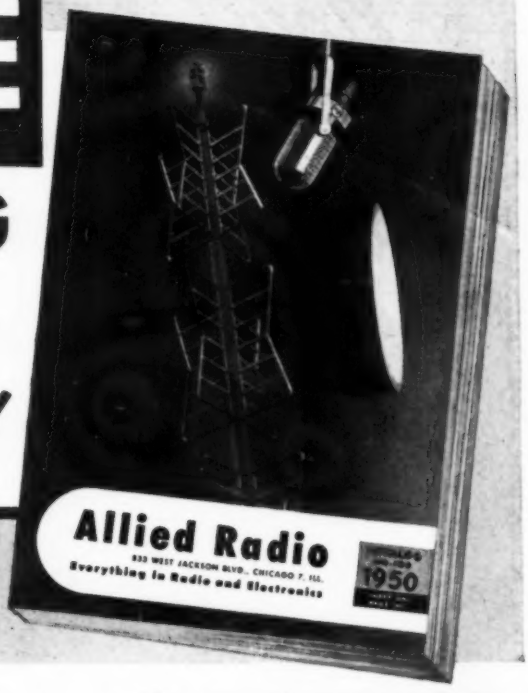

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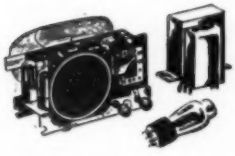

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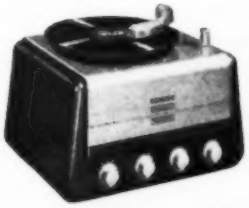

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1	100	5	4700	1	82000	1	2.2 meg.
1	150	1	6800	10	0.1 meg.	1	2.7 meg.
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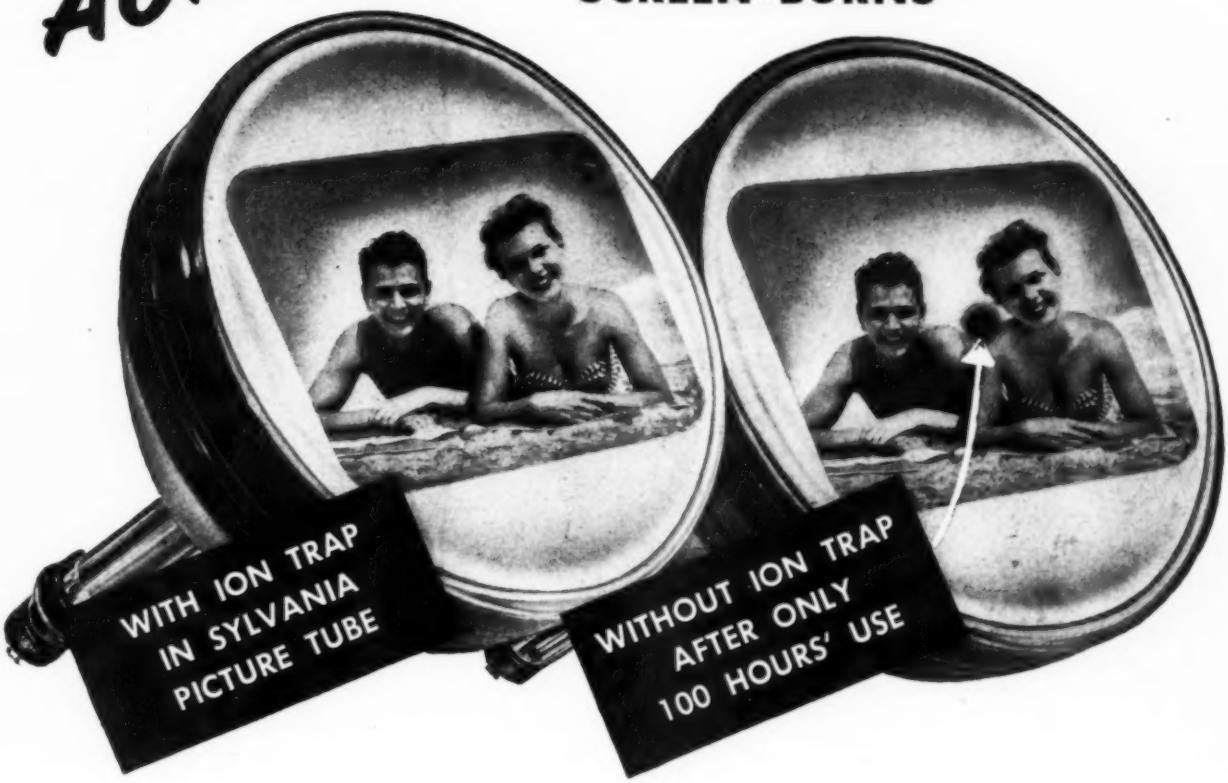
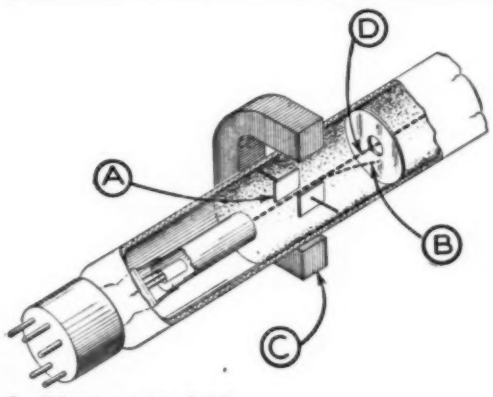


HERE'S HOW IT WORKS...



A. Electrostatic field

B. Ions are bent away from normal axis of tube by electrostatic field

C. External magnet neutralizes the effect of the electrostatic field on the electrons

D. Electrons follow a straight line

Heavy ions are thus trapped in the electron gun while the electrons pass through to strike the fluorescent screen.

Owners of television sets equipped with Sylvania Television Picture Tubes report their screens still bright and unblemished after more than 1000 hours' use. Much credit for this top quality performance belongs to Sylvania scientists who hold the basic patents on the magic "ion trap." With this device these scientists prevented destruction of the fluorescent screen by heavy ion bombardment. So successful is this ion trap that now many other major TV tube makers are using it under agreements with Sylvania.

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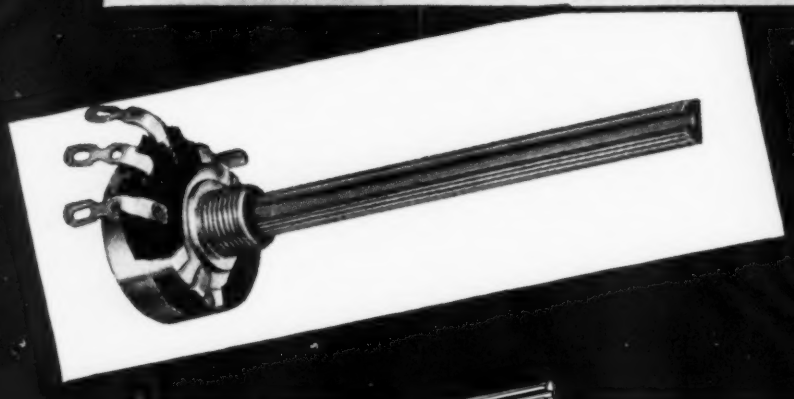

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Gives widest coverage of replacement with nominal stock of controls. Eleven types of shafts let the technician meet many special requirements without expanding control stock. These shafts are sealed in cellophane and individually packaged.

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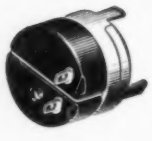
New Resilient Retainer Ring contributes unusually smooth rotation. Your customers will notice the quality "feel" at once. Cushioned Turn does for IRC Q Controls what low-pressure balloon tires do for automobiles.



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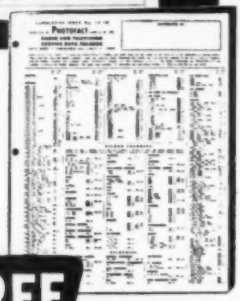

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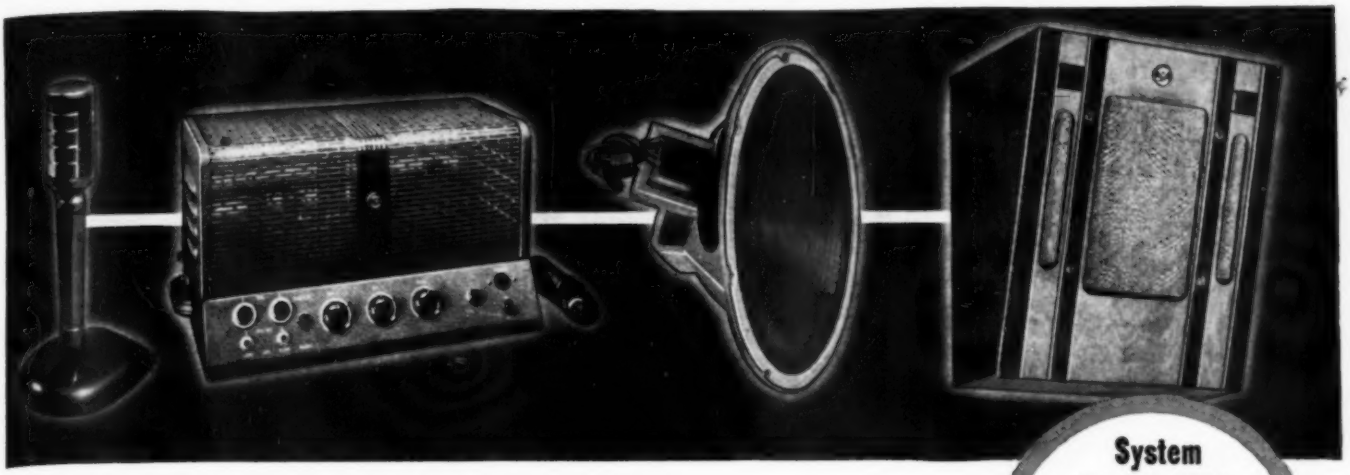

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This complete, ready-to-operate, matched sound system surpasses any sound system you could buy at this sensational low price.

AMPLIFIER: High gain, wide range, low-distortion, 25-watt amplifier with inverse feedback. 2 high impedance microphone inputs—high and low impedance phono inputs—speech music switch and tone control—complete with tubes.

MICROPHONE: De luxe dynamic high impedance microphone—modern, rugged, lightweight, with 15-ft. cable and matching base.

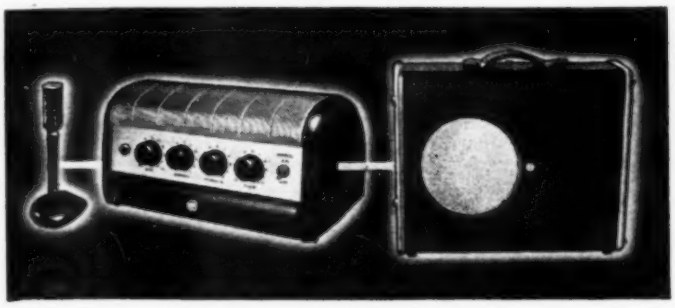
SPEAKER: 12-inch PM speaker with 6.8 ounce Alnico V magnet and multi-tap line matching transformer.

BAFFLE: Attractively styled, sloping front, walnut finish, wood baffle.

EXTRA SPEAKERS AND BAFFLES: Available at comparably low prices.

System P-525-12W

$99.50* Suggested list price.



RCA PORTABLE SOUND SYSTEM

Feature for feature, there's more value for your money in this high-quality low-priced portable sound system. Uses same microphone described above. De luxe high-gain, wide-range amplifier with inverse feedback is matched with a highly efficient Alnico PM speaker to give acoustical output equivalent to a conventional 30-watt portable PA system. Separate inputs for microphones and phonograph. Handsome inlaid steel-band reinforced luggage type carrying case covered with gray and black DuPont Fabrikoid.

Weight 45 lbs. complete.

MODEL SP-15A

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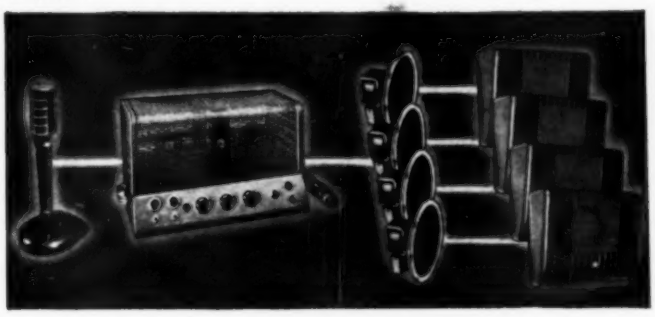

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An ideal sound system for general applications—uses same 25-watt amplifier and microphone described in system P-525-12W—with 4 high efficiency 6-inch PM speakers with multi-tap line matching transformers and beautiful molded fibre, sloping front baffles. Compare this unparalleled equipment value.

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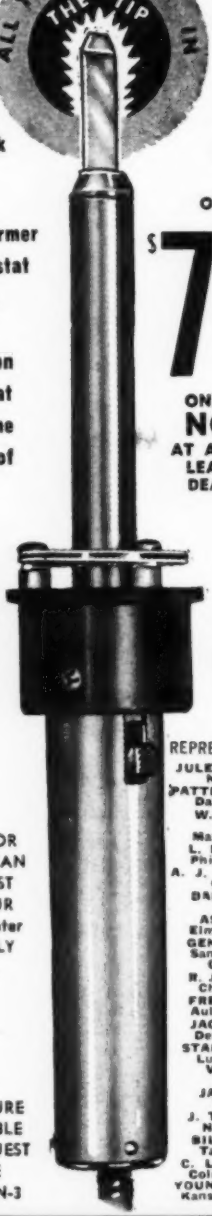

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Spot Radio News

★ *Presenting latest information on the Radio Industry*

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

VERY-HIGH AND ULTRA-HIGH TV channel allocation, a desk-pounding, raging topic in industry and government, rose to eruptive stages on many fronts in Washington when the FCC released its proposed channel plan providing higher band stations in some communities which also have lower band telecasters, deleting a few very-high band applicants and generally setting up a new 42-channel upper-spectrum system for most of the nation.

Although many applauded the plan, citing that it had substantial merit and could be applied, perhaps in a modified manner, to allow TV to become a national facility very quickly, there were others who vigorously denounced the approach.

One of the most outspoken of the critics was the FCC Bar Association who declared that they opposed the right of the Commission to establish an allocation table for TV stations, since, in their opinion, the ruling conflicts with the Communications Act, providing that frequencies must be assigned according to the demand. According to a legal interpretation, this *demand* must be determined by applications, and, therefore, applications should be the determining factor for TV channels rather than the table itself. The bar experts did admit though that the allocation table could be used as a guide in the assignment of channels.

In another dissenting view on the plan, a representative of the *Toledo Blade Company* said that the proposal would confuse residents of his city, Toledo, which is now scheduled to have one standard and two higher band stations, since they would either have to purchase two sets (or one with a converter) or simply wait for the high- and low-band sets. Since the possibility of immediate ultra-high service is remote, the Toledo attorney indicated only partial receiving service would be available for quite a while. The city should be provided with all of the stations in one range and not intermixed, he emphasized.

Engineering and economic problems, mentioned on many occasions during the hearings, were reemphasized in negative views of the allocation plan. Attorneys for WNOW and WNOW-FM declared that power assignments should be based on the community need. It is necessary, they said, that the plan permit the greatest possible leeway to fit or tailor the service contours to the needs and requirements of the areas being served. In their opinion . . . "the only rigid specifications that should be tolerated are the assignment of the channels to the various cities, the designation of the minimum area to be served by each of the stations and provisions of adequate power for that purpose, and the specification of the minimum contour beyond which interference from other stations will not normally be tolerated."

The power requirement cited in the proposal was also criticized by a consulting engineer representing Montana interests. He pointed out that the high power suggested for metropolitan stations, applied in cities with comparatively small population, such at Butte, Great Falls, Billings, or Missoula, would place a financial burden on the broadcasters and suggested that lower powers of the 500 watt type be allowed and authorized as "Grade A," service now reserved for the 10 kw. operations. He felt that the lower power transmitter would be able to serve the area quite well, and afford an attractive rate for advertisers in relation to the number of persons being serviced.

Approval for the plan appeared in a statement from TV pioneer Dr. Allen D. DuMont, which revealed that the proposals would provide satisfactory service if the channel spacings were controlled. However, he felt that the ultra-high allocations would require a bit of shifting, particularly where provisions for communities for a thousand or so had been made. While the installation of a transmitter in such an area might be an ideal move, the economic problems would be staggering, he indicated.

Dr. DuMont also was critical of the power requirements, disclosing that high power at the higher frequencies is many years away, and, therefore, a more equitable lower power assignment should perhaps be included at this time. Commenting on the ultra-high broadcasting experiences of WABD, Dr. DuMont said that thus far only powers of 40 watts or so have been possible providing a coverage of two or three miles, and before the end

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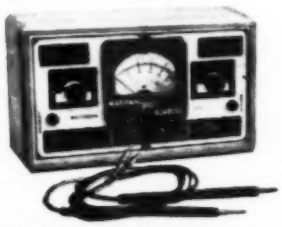

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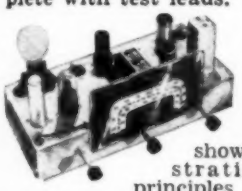
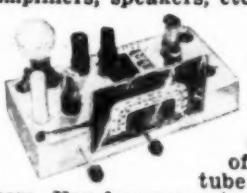


SIGNAL GENERATOR

You construct the Transitron Signal Generator shown here, demonstrating Transitron principles in both R.F. and A.F. stages. You study negative type oscillators at firsthand.

AUDIO OSCILLATOR: An electronic device, which produces audio-frequency signals for modulating R.F. (radio frequency) carrier waves, testing A.F. (audio frequency) amplifiers, speakers, etc.



T.R.F. RECEIVER

You build several T.R.F. Receivers, one of which, a 4-tube set, is shown here. You learn construction, alignment, make receiver tests, and do trouble shooting.

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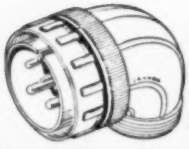

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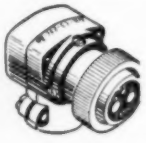

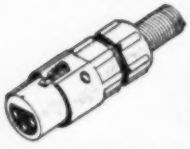

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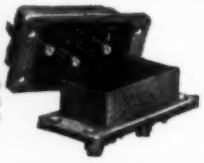

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of the year it may be possible to boost the power to 300 watts and increase the range accordingly.

Broadcast station and network engineers felt that while the plan was an effective guide to an allocation solution, years would pass before the ultra-high program would be practical. They felt that the low powers now available and the limited knowledge of transmission and reception on the high bands would curtail widespread operations. It was generally admitted, however, that availability of the channels would accelerate interest and provide valuable application information.

THE FCC OFFICES in the New Post Office Building in Washington, hectic receiving point of the stormy proposal statements, were also the scene of a bit of sharp statement making, with a tartly worded letter going to *A. T. & T.* asking . . . "why the intercity video transmission facilities provided to date by *Bell System* have not been capable of utilizing the full 4.5 mc. bandwidth of television broadcast transmissions under the Commission's engineering standards."

The Commission also asked the telephone company to reveal what plans it has to improve the present intercity facilities to make possible transmission of a greater bandwidth, specifying the routes and dates on which improved facilities will be available. The boys in Washington also wanted to know when the telephone company would be able to provide a nationwide 4.5 mc. intercity service, and what means, coax or microwave, would be available for the service.

Color was also touched on in the telephone company letter, with a request for information on the . . . "possibilities of the *Bell System* providing intercity video transmission facilities capable of transmitting color television signals on a nationwide basis in the event the Commission should authorize commercial color broadcasting."

The 'phone experts were also asked to describe their ability to provide intercity facilities for the ultra-high operation, involving remote pickups, studio-transmitter links and other types of loop services.

A similar letter went to the *Western Union Telegraph Company*, WU, however, being asked only to indicate if they could provide full 4.5 megacycle service, since at present their link setups are purely experimental and involve microwaves for point-to-point operation.

EXPERIMENTAL TV licensees were also herded into the inquiry ring with a blunt letter asking, not only about their standard research and experimental activities, but about any color work they may be doing. Specifically the Commission wanted to know what has been learned about color breakup, flicker, color fringing, image registration, color fidelity, picture brightness, camera light efficiency, definition, field tests, and whether or not transmitters or receivers could be modified to provide color TV service.

COLOR TV not only appeared to be of deep concern to the Commission gentlemen, but to the legislators on Capitol Hill. The special Bureau of Standards committee probe, suggested by Senator Edwin Johnson and detailed briefly in last month's column, was officially approved during the summer months with a four-point program set up for consideration: Bandwidth for suitable color pictures, present and near-future prospective development of transmitting and receiving equipment, propagation factors in the 174-216 and 470-890 megacycle bands as affecting allocations for color television service, and the situation concerning adaptability of present receivers to color use, or to receive in black and white a program being transmitted in color.

Senator Johnson, serving as chairman of the Senate Committee on Interstate and Foreign Commerce, indicated that the committee's report should be invaluable to everyone, particularly in view of the impartial interests of the members of the group of which E. U. Condon, director of the Bureau of Standards, is chairman. Others on the committee are Newbern Smith, chief of the Central Radio Propagation Laboratory of the Bureau of Standards; Stuart L. Bailey, IRE prexy; W. L. Everitt, dean of the College of Engineering of the University of Illinois, and Donald Fink, chairman of the Joint Technical Advisory Committee.

Industry has also decided to do a bit of color TV probing, a committee of ten having been appointed by the RMA: F. J. Bingley, WOR; Lewis Clement, *Crosley*; R. B. Dome, *General Electric*; E. W. Engstrom, *RCA*; Donald Fink; T. T. Goldsmith, *DuMont Labs*; Peter Goldmark, *CBS*; G. E. Gustafson, *Zenith*; R. F. Guy, *TBA*, and D. B. Smith, *Philco*.

Their reports, which will be forwarded to the Commission as an official view of the association, will undoubtedly play a vital role in the final allocation decisions issued in Washington.

SATELLITE TV stations will serve rural areas in the next five to seven years, according to TBA Prexy Jack Poppele. In an address at the annual convention of the American Association of Agricultural College Editors at Cornell University, Poppele, who is also chief engineer and vice-president of WOR and WOR-TV, said that each satellite would rebroadcast to its service area, covering about forty miles or more, programs originating at the key station. In addition these stations would originate film and slide copy of particular interest to their rural

(*Continued on page* 171)

YOU Need My PRACTICAL Training to Make Money in TELEVISION-RADIO and ELECTRONICS!

Learn at HOME IN YOUR SPARE TIME

I'll Send You 8 BIG KITS of Radio Parts and Equipment . . .

NOW IS THE TIME To Get Into This Fast Growing Industry—Prepare For A Fine Paying Job Or Your Own Business!

If you want to get into Radio-Television and Electronics . . . you owe it to yourself to get the facts about my training. I have trained hundreds of men to become outstanding service technicians—and I'm ready to do the same for you. Whether your goal is a fine paying job in one of Radio's many branches—or a successful Radio and Television business of your own—*you need the kind of training I offer!* My training is practical and down to earth. YOU NEED NO PREVIOUS EXPERIENCE. You'll be astonished at your rapid progress. I start you with basic fundamentals and give you plenty of practical shop-bench training with many kits of parts I send you. This is the training that sticks with you and makes money for you on the job!

Get Paid For Spare Time While Learning

Soon after you start training I send you my famous BUSINESS BUILDERS that show you how to make money in spare time doing interesting Radio jobs. Look at the useful and valuable equipment you get while training with me (illustrated at left)—I send you these 8 big kits of Radio parts and equipment and help you build step-by-step a powerful 6-tube superhet radio, a 16-range test meter, plus other mighty useful equipment for Radio and Television servicing. You will perform over 175 fascinating experiments while training. You will learn about Television—so that you will be qualified to step into this fast growing, profitable field. I also send you many valuable service manuals, diagrams and my book telling exactly how to set up your own Television and Radio shop. *I want you to learn all about my training*—and that is why I urge you to clip and mail the coupon below for my two big FREE Radio books. I employ no salesmen—and nobody will call on you. The important thing is to act now and get the facts.

HAVE A BUSINESS OF YOUR OWN

A profitable Radio and Television Service Shop may be started with little capital. I will show you how to get started and how to build your small business. At left is pictured one of my graduates, Mr. Merrit C. Sperry of Fairmont, Minnesota in his own shop. The way is also open for you to build a good SERVICE BUSINESS FOR YOURSELF.

ALL KITS ARE YOURS TO KEEP

Each of the hundreds of Radio parts and other items I send my students is theirs "for keeps." You may use this equipment in your Radio and Television service work and save many dollars by not having to buy expensive "ready-made" test equipment. Each of my 8 kits will help you advance and learn important steps in Radio and Television servicing.

CALVIN SKINNER of New Orleans, La. tells us he makes $5 to $10 in spare time repairing radios. He is now also working with his own Television set.

LOREN D. SAUCIER of Coloma, Mich. reports that my training has made it possible for him to repair large numbers of Radio and Television receivers.

RADIO AND TELEVISION INDUSTRY BOOMING

You couldn't pick a better time to get into Radio-Television and Electronics. New Television stations are going on the air to serve every major city—hundreds of new AM and FM Radio broadcasting stations are also on the air to serve practically every community in America. All this creates new and bigger opportunities for the trained man who knows Radio-Television and Electronics. Good Radio and Television service men are needed NOW!

VETERANS

THIS TRAINING AVAILABLE TO YOU UNDER THE G.I. BILL

My Training Includes:

Radio Servicing
Television
FM Frequency Modulation
Public Address and **High Frequency Applications**

These Two Big Radio Books FREE!

Just mail coupon for a FREE sample Sprayberry Lesson and my big FREE book, "How To Make Money In Radio-Television and Electronics." Learn why my really *practical* training is best of all for you. Discover what's ahead for you in the fast moving Radio-Television and Electronics industry. No obligation. Don't delay—the future is too important to you. Mail the coupon now—and count on me for fast action.

SPRAYBERRY ACADEMY OF RADIO
111 N. CANAL, DEPT. 25-B, CHICAGO 6, ILL.

RUSH COUPON Today!

SPRAYBERRY ACADEMY of RADIO, Dept. 25-B
111 North Canal St., Chicago 6, Ill.

Please rush my FREE copies of "How To Make Money In Radio-Television and Electronics" and "How To Read Radio Diagrams and Symbols."

Name..... Age.....

Address.....

City..... State.....

( ) Check here if you are a Veteran.

Centralab Reports to

USE CENTRALAB REPLACEMENT CONTROLS

. . . for Finer Performance!

MODEL "R" WIRE-WOUND Radiohm Controls are used in voltage divider circuit applications. Wound in linear taper only, the Model "R" gives you smooth, quiet operation, a resistance range of 2 to 10,000 ohms and a rating of 3 watts.

MODEL "M" Radiohm — one of the most popular CRL Controls — is used in voltage divider, antenna shunt, C-Bias, AF grid or tone, series in RF plate applications. Of medium size, the *Model "M"* control is equipped with wiping contact and wall-type resistance element. It's case of molded phenolic is 1-3/32" in diameter and 9/16" deep. Its terminals are treated for easy soldering. Its shaft — 3" long from the end of the 3/8" bushing — is of the universal, fluted full-length mill type. The *Model "M"* is generally available with four tapers, a resistance range of 500 ohms to 5 megohms and is rated at 1/2 watt.

ADASHAFT* Control is the same as *Model "M" Radiohm* except that it offers improved utility with the attached *Adashaft*. *Adashaft* lets you handle almost any type of control replacement without carrying a large stock. Quickly and easily attached, forms a solid, integral unit. *Adashaft*, without tap, has four tapers, a resistance range of 10,000 ohms to 3 megohms, and is used in antenna, C-Bias, voltage divider, tone control, AF grid or tone applications. *Adashaft*, with tap, has a resistance range of 250,000 ohms to 2 megohms, taps at 75,000, 150,000, 300,000 and 600,000 ohms, and is used in audio grid applications. *Reg. U. S. Pat. Off.

Speed up Replacements with the Handy CRL Volume Control Guide!

Here's a book that makes your job easier by listing all the replacement controls needed for both new and old receivers. You can get a *free* copy from your CRL distributor or by writing Contralab direct. Then keep it on your service bench for quick, accurate reference.

Service Engineers!

Economy-wise listeners are making greater use of their present radio sets as fall and winter programs return to the air. And that's a signal to forward-looking service engineers to make sure they have an adequate number of high quality CRL replacement parts on hand. No matter whether it's controls, switches, capacitors or industrial parts you need you'll find your Centralab distributor can supply you with every type from his complete CRL line. What's more you can be sure of getting quick service. Nearly 600 Centralab distributors are conveniently located throughout the United States and Canada. Don't wait. Be prepared for the increased demand for radio servicing by getting in touch with your nearest CRL distributor now.

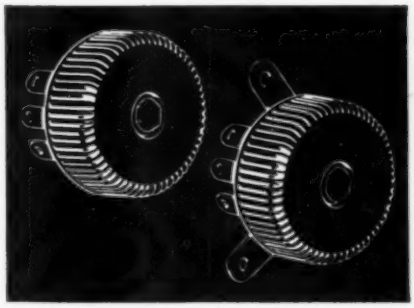
Centralab

CRL

Division of GLOBE-UNION INC. • Milwaukee

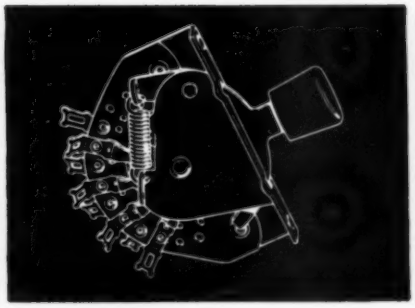
ATTENTION JOBBERS: Industrial, government, amateur and experimental needs are a large part of the ever-increasing jobber market. Build greater sales in these markets by promoting profit-making Centralab parts.

Ask Your Distributor for These CRL Parts



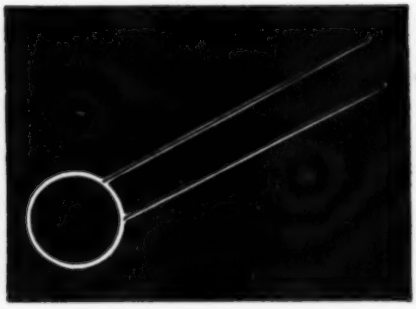
CONTROLS

MODEL "M" for voltage-divider antenna shunt and "C" bias control, tone control, AF grid control. MODEL "1" for all miniature application such as hearing aids, portable radio receivers; rated at 1/10 watt, actually smaller than a dime. MODEL "R", wire wound, for voltage divider, antenna shunt, "C" bias, AF grid or tone control circuits.



SWITCHES

ROTARY for band change, meter, intercom circuits; made in ceramic and phenolic models. ROTARY SPRING RETURN for meter selection, intercom, phono-radio applications. MEDIUM DUTY for band changing in low power exciter-transmitters and receivers. LEVER ACTION for intercom, speaker, microphone and other applications.



CAPACITORS

TC HI-KAPS for correcting temperature drift in TV, FM, AM, VFO circuits. TUBULAR BC and KOLORDISK BC HI-KAPS for by-pass and coupling applications in non-resonant, TV, AM, FM, AF, HF, VHF, UHF circuits. HI-VO-KAPS for TV power supplies. TRIMMERS for padder applications in TV, AM, FM, and HF circuits.

BUY THE BEST • THE V.O.M.A. THAT DOES MORE

MORE FOR YOUR MONEY

Triplett Model 630

$37.50 Dealer Net

In the relatively short time since Model 630 was introduced to the trade it has steadily risen to the top in sales. The reason is obvious. Here is a Volt-Ohm-Mil-Ammeter that does more . . . has proven components . . . and will give a lifetime of satisfaction. All the engineering skill and facilities of the industries' largest manufacturer of Volt-Ohm-Mil-Ammeters joined forces to make it outstanding in every way. Look over all the features and you too will buy Model 630.

NOTE THESE SENSATIONAL IMPROVEMENTS:

★ **Individual Scales** with separated spacing are easy to read.

★ **Large 5½ Inch Meter** In Special Molded Case Under Panel.

★ **Resistance Scale Markings** from .2 Ohms to 100 Megohms—Zero Ohms Control Flush With Panel.

★ **Only One Switch**—Has Extra Large Knob 2½" Long—Easy To Turn—Flush With Panel Surface.

★ **Enclosed New Molded Selector Switch** and insulated resistor housing in unit construction.

★ **All Resistors** Are Precision Film or Wire Wound Types For Permanent Accuracy.

★ **Batteries Easily Replaced**—Balanced Double-Contact Grip. Spiral Spring—Battery for Ohms test due to low drain insures shelf-life usage.

TECH DATA

D.C. VOLTS: 0-3-12-60-300-1200-6000 at 20,000 Ohms/Volt
A.C. VOLTS: 0-3-12-60-300-1200-6000 at 5,000 Ohms/Volt
D.C. MICROAMPERES 0-60 at 250 Millivolts
D.C. AMPERES 0-12 at 250 Millivolts
D.C. MILLIAMPERES 0-1.2-12-120, at 250 Millivolts
OHMS: 0-1000-10,000; (4.4 Ohms and 44 Ohms center scale)
MEGOHMS: 0-1-100 (4400-440,000 at center scale)
DECIBELS: —30 to +4, +16, +30, +44, +56, +70
OUTPUT: Condenser in series with A.C. Volt ranges
High voltage Probes available, extra; also plug-in shunts for other current measurements to suit special needs.

Laboratory Standard Model 630-A—All scales on this model are hand drawn and hand stepped, used with mirror for extreme accuracies, beyond the average servicing needs of the model 630.

Triplett Model 630-A **Dealer Net $47.50**

VOMA JR.—A NEW VOLT-OHM-MIL-AMMETER

Handy "POCKET-SIZE LABORATORY" By Triplett

VOMA Jr. MODEL 666-R has many of the design features of the popular Model 630:

1. Switch and controls flush with panel.
2. Enclosed molded selector switch.
3. Exclusive Unit construction-resistor housing integral with switch.
4. Resistors Precision wire wound and permanent film type.
5. Resistance Measurements to 3 Megohms.
6. Batteries with spiral spring contacts, easily replaced.

VOMA Jr. MODEL 666-R . . . $24.50
U.S.A. Dealer Net Price

Note: *Model 666-HH The Original Pocket-Size Lab—still a favorite with many. U.S.A. Dealer Net $22.00.*

TECH DATA

D.C. VOLTS: 0-10-50-250-1000-5000, at 1000 Ohms/Volt
A.C. VOLTS: 0-10-50-250-1000-5000, at 1000 Ohms/Volt
D.C. MILLIAMPERES: 0-10-100, at 250 Millivolts
D.C. AMPERES: 0-1, at 250 Millivolts
OHMS: 0-3000-300,000 . . . . (20-2000 at center scale)
MEGOHMS: 0-3 . . . . . (20,000 ohms center scale)

Precision first...to Last

TRIPLETT

TRIPLETT ELECTRICAL INSTRUMENT COMPANY • BLUFFTON, OHIO, U.S.A.

In Canada: Triplett Instruments of Canada, Georgetown, Ontario

New skyrider

Custom Installation TV

Complete front panel assembly and complete cabinet also available.

A *new* chassis, specially designed for big picture-tube operation. Completely aligned and tested. Regular RMA 90-day guarantee applies to all parts. See your local parts distributor for details.

Free

Send for folder of original custom-installation designs.

Model 524 with 10-inch Tube . . $159.50

Model 521 with 12½-inch Tube . . $189.50

Model 520 with 16-inch Tube . . $249.50

skyrider

5th and Kostner Avenues • Chicago 24, Illinois

TV EXTRA EDITION

WARD MINUTE MAN

1949 IS TV YEAR

WARD PRODUCTS CORPORATION • 1523 E. 45TH ST., CLEVELAND, OHIO • OCTOBER 1949

WARD SMASHES TV ANTENNA INSTALLATION COSTS!

IT COSTS ONLY 6c IN LABOR TO ASSEMBLE WARD'S SENSATIONAL MINUTE MAN ANTENNA

(WP) CLEVELAND, OHIO

The Chief Engineer of the Ward Products Corporation states that the new sensational Minute Man antennas are being made of PERMA-TUBE — a newly perfected non-corroding coated steel tubing, created especially for Ward by the Jones and Laughlin Steel Corp., Pittsburgh, Pa. Independent laboratory tests on over 30 metals commonly used for antennas have proved PERMA-TUBE the best for all weather installations. Aluminum is too weak and other types of coated steel corrodes. Ward is the only manufacturer using PERMA-TUBE in constructing antennas. See your Ward Distributor today.

Dick Moss, television engineer, flicks up dipole in assembly operation of Ward Minute Man antennas. (Model TV-46).

A few seconds later and Dick snaps the high frequency dipole into position. It costs only 6c in labor to assemble this Ward Minute Man antenna.

FLASH!

WARD USES PERMA-TUBE IN CONSTRUCTING MINUTE MAN ANTENNAS.

(WP) CLEVELAND, OHIO

The Ward Products Corporation, a Division of the Gabriel Company, disclosed today their new Minute Man line of TV antennas. These 13 antennas, ranging in list prices from $2.45 to $49.95 are completely pre-assembled. Where it formely took two installation men three-quarters of an hour (or approximately $7.50 in labor) to assemble the ordinary TV antenna, one man can assemble any Ward Minute Man antenna in a few minutes. This is the greatest technical engineering improvement in the antenna field and the Ward engineers are to be congratulated on its achievement. They have spent many months in their laboratory perfecting the many ingenious construction features. See your Ward distributor today.

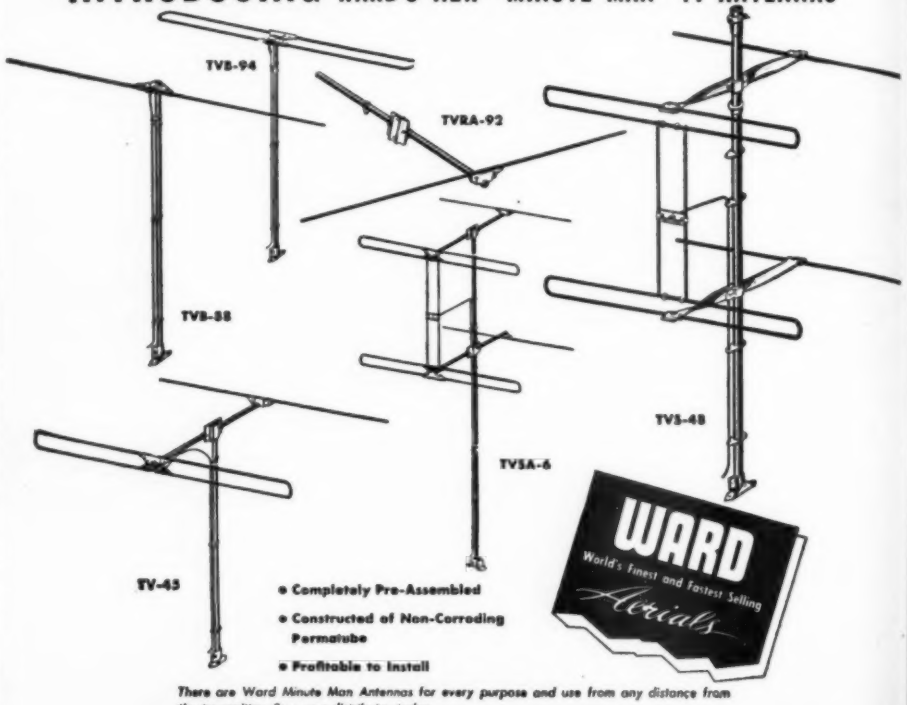
GREATER INCOMES AND PROFITS REALIZED BY INSTALLING WARD ANTENNAS.

(WP) NEW YORK, N. Y.

Now you can make big money on a standard installation fee. It has been reported that servicemen and retailers are realizing greater profits by installing Ward Minute Man Antennas. The quick 3 minute installation makes the big difference. It means more installations per day and at greater returns. No consumer complaints have been registered by big labor bills. See your Ward distributor today.

See Your Ward Distributor Today

INTRODUCING WARD'S NEW "MINUTE MAN" TV ANTENNAS



- Completely Pre-Assembled
- Constructed of Non-Corroding Permatube
- Profitable to Install

There are Ward Minute Man Antennas for every purpose and use from any distance from the transmitter. See your distributor today.

THEY LAST A LIFETIME!

SAVE 50% with LABORATORY PRECISION

EICO INSTRUMENTS & KITS

Anyone Can Build Them!

HIGH-PRECISION VACUUM TUBE VOLTMETER

Model 221-K

$23.95

Tops in work bench versatility. 15 different ranges! AC and DC ranges: 0/5/10/100/500/1000 volts. Electronic ohmmeter ranges from .2 ohms to 1000 megohms in 5 steps. New features include Zero Center for TV discriminator alignment. DC input impedance is 26 megohms. Exceptionally accurate, big 4½" meter cannot burn out. Double triode balanced bridge circuit assures stable guaranteed performance. Sturdy portable steel case with etched, rubproof panel. 110-130 V. AC 50-60 cycle. Size: 9⅛"x6"x5".

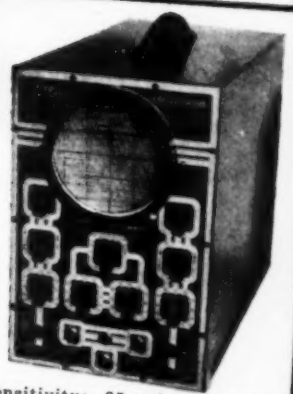
FACTORY-WIRED VTVM

Model 221. Same, but completely wired, calibrated, and tested..... **$49.95**

5" 'SCOPE

Model 400-K

$39.95

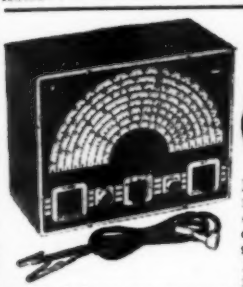


Quality throughout! Laboratory precision scope, for FM, AM, & TV servicing. Deflection sensitivity: .65 volts per inch full gain. Linear sweep with 884 gas triode. Horizontal sweep circuit, 15 to 30,000 cycles. Frequency response of horizontal and vertical amps is from 50 to 50,000 cycles. Provision for external synchronization, test voltage, and intensity modulation. Complete with 2—6SJ7's, 2—5Y3's, 884, and 5BP1 CR tube. Graph screen for measuring peak to peak voltages. Operates on 110 to 130 volts AC, 50-60 cycles. All controls on front of handsome 3-color etched, rub-proof panel. Size: 8½"x17"x13" high. Shpg. wt. 30 lbs. As with all EICO kits, easy-to-follow Pictorial and Schematic diagrams are included.

FACTORY-BUILT OSCILLOSCOPE

Model 400. The same high-quality, life-long instrument, but fully wired, assembled, and tested..... **$69.95**

NEW! MODEL 320-K SIGNAL GENERATOR



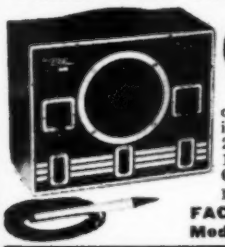
$19.95

An excellent instrument for service, lab, and school use. Can be used for FM, AM alignment and to provide TV marker frequencies. Highly stable Hartley oscillator has range of 150 kc to 102 mc with fundamentals to 34 mc. Colpitts audio oscillator supplies **pure 400 cycle sine wave** voltage for modulation. Audio oscillator voltage can be used for testing distortion in audio equipment, bridge measurements, etc. Handsome etched panel with easy-to-read calibrations. Easily assembled and aligned. Complete with tubes.

FACTORY-WIRED AND ALIGNED

Model 320. Ready to use..... **$29.95**

VERSATILE MULTI-SIGNAL TRACER



$18.95

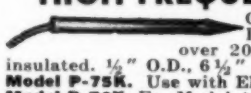
Model 145-K. Versatile, high gain—high frequency instrument. Self-contained test speaker permits audible signal tracing of RF, IF, FM, audio, and video circuits. Has provision for visual tracing with VTVM. Response is well over 200 mc 3-color hammertone panel. 110-125 V. AC. Size: 10"x8"x4¾". Comes complete with tubes and diode probe in kit form.

FACTORY-BUILT AND TESTED

Model 145. Ready to operate.. **$28.95**

Watch for the new EICO Sweep Generator Kit—Coming soon!

PENCIL-TYPE HIGH FREQUENCY RF PROBE KITS



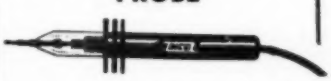
Germanium crystal probes for visual RF signal tracing and measurements to over 200 megacycles. Metal encased, tenite insulated. ½" O.D., 6½" long.

Model P-75K. Use with EICO Models 221, 113A, or any VTVM.

Model P-76K. For Model 400 or any oscilloscope....Only **$3.75**

Models P-75 or P-76. Same as above but factory wired and tested. **Each**..... **$7.50**

HIGH VOLTAGE PROBE



Model HVP-1. High Voltage Probe which measures up to 30,000 volts. Ceramic HV Multiplier resistor (removable) makes probe adaptable to most VTVM's and 20,000 ohms per volt meters with 1000 or 5000 volt scales. Lucite head has high dielectric and low leakage path. Extra-safe handle. Specify your instrument to your jobber. Complete, with resistor.. **$6.95**

Pocket VOLT-OHM MILLIAMMETER

Model 511-K. A "must" for serviceman! Perfect kit for the beginner. 5 AC ranges to 1000 V; 5 DC ranges to 2500 V; Ohms, to 1 meg. 3" precision meter. New improved Germanium crystal, rectifier circuit..... **$14.95**

Model 511. Factory-wired, tested..... **$17.95**

EASY-TO-FOLLOW SCHEMATIC & PICTORIAL DIAGRAMS

come complete with every EICO Instrument Kit. Each kit fully guaranteed to operate perfectly when assembled according to our simple instructions!

EXCLUSIVE LIFE-TIME REPAIR SERVICE: For a nominal charge, we will repair and service your EICO instrument, **regardless of its age!**

Prices Higher on West Coast

DELUXE SIGNAL GENERATOR

MODEL 315

EICO presents this **completely wired,** ready-to-use Signal Generator with 1% accuracy! A wonderful test instrument with dozens of expensive features. Frequency range: 75 kc to 150 mc. Has microcycle band-spread vernier tuning for FM, AM, and TV. Voltage regulator permits line variations from 95 to 135 V without affecting accuracy. Write for full details. Completely wired and assembled..... **$59.95**

SEE THEM—TRY THEM—AT YOUR LOCAL JOBBER!

EICO Instruments and Kits are **on display** at your local jobber—the nationally advertised kits which you can see and use before you buy. You take no chances with EICO!

ELECTRONIC INSTRUMENT CO., INC.

276 Newport Street, Brooklyn 12, N. Y.

You'll Get the MOST FOR Your MONEY by specifying PYRAMID Capacitors

WRITE FOR COMPLETE LITERATURE

Representatives and Distributors Throughout the U.S.A. and Canada

PYRAMID CAPACITORS

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Paterson, N. J., U.S.A.
TELEGRAMS: WUX Paterson, N. J.
CABLE ADDRESS: Pyramiduso

Within the INDUSTRY

SCOTT RADIO LABORATORIES has obtained control of the *Bissell-Weisert* retail outlet, located at 540 N. Michigan, Chicago, Ill. The company reported that it plans to use these offices to study the constant and rapid changes being made in the merchandising of television and radio-phonograph sets.

In the announcement it was stated that the name and personnel of *Bissell-Weisert* will remain unchanged, and John C. Weisert, as president, and Robert H. Weisert, treasurer, will operate the business, taking an active interest in *Scott Radio Laboratories.*

* * *

LLOYD M. HERSHEY, formerly assistant to the chief engineer of the *Hallicrafters Company,* has been made director of research for *General Instrument Corporation.*

In his new appointment, Mr. Hershey will concentrate on the development of new radio and television parts for *General Instrument Corporation.* Among other duties, he will also coordinate activities in this field between the company and radio and television manufacturers.

Mr. Hershey brings to his new position a good deal of experience, gained while he was in charge of development research for *Hazeltine Corporation,* prior to his connection with *Hallicrafters.*

* * *

KUDNER AGENCY, INC., has moved its radio and television department to new offices at 724 Fifth Ave., N.Y.C., it was recently announced, with the new office under the direction of Myron P. Kirk. Growth of the agency and increased staffing of the radio and TV department made the former space at 630 Fifth Avenue, the company's main office, insufficient for its needs. . . .

SORENG MANUFACTURING CORPORATION celebrates its 25th anniversary by moving into its new one-story plant in Schiller Park, west of Chicago. Comprising an area of 60,000 square feet, the plant will have radiant heating, fireproof construction, and the newest ideas in material handling and storage. . . . The entire organization of the **SPRAYBERRY ACADEMY OF RADIO** was recently moved to its new Chicago location at 111 N. Canal Street, Chicago 6, Ill. Because of the increasing importance of Chicago as a television and radio development and manufacturing center, Mr. Sprayberry expressed the opinion that he will be able to include all new TV and radio developments in his training as soon as they are announced.

* * *

PAUL H. WENDEL, writer, editor, and product market analyst, has announced that a Television Technicians' Lecture Bureau, 55 E. Washington Blvd., Chicago, has been established with the purpose of sponsoring a nationwide program of non-commercial lectures for radio and television technicians.

Lecture staff of the bureau will be headed by Walter R. Jones, of Cornell University, and A. C. W. Saunders, director of the *Saunders Radio and Electronics School,* Boston, Mass.

Technicians attending the lectures, an itinerary for which will be announced shortly, will receive a notebook containing a synopsis of the highlights of the lectures, with space for note-taking. To maintain the lectures on an impartial and unbiased basis, an admittance fee will be charged.

First five lectures will cover practical applications of test equipment in AM, FM, sound, and television servicing; TV antennas and the installation of TV receivers; replacement parts and components in AM, FM, sound, and TV; practical servicing of TV receivers; and setting up of an independent radio and television service business.

* * *

HOWARD H. WEBER, whose appointment as general sales manager of the wire and cable department of *United States Rubber Company* was recently announced, will supervise sales of rubber insulated building wire, service entrance cable, armored and non-metallic sheathed cable, portable cord and cord sets, *Uskon* electric radiant heating, battery separators, *Electrix* wiring devices, and other specialized electrical wires for the radio, television, mining, construction, and electrical industries.

* * *

HAYES A. HOLLIBAUGH, vice-president of *Radio Equipment Co., Inc.,* of Indianapolis, Indiana, was presented with a bronze plaque for rendering an outstanding service to radio and television technicians of Indiana and the television industry.

The plaque was given to Mr. Hollibaugh by the Indianapolis Radio & Television Technicians' Association at a dinner in his honor August 11, 1949.

Since November, 1948, Mr. Hollibaugh has operated a television tech-

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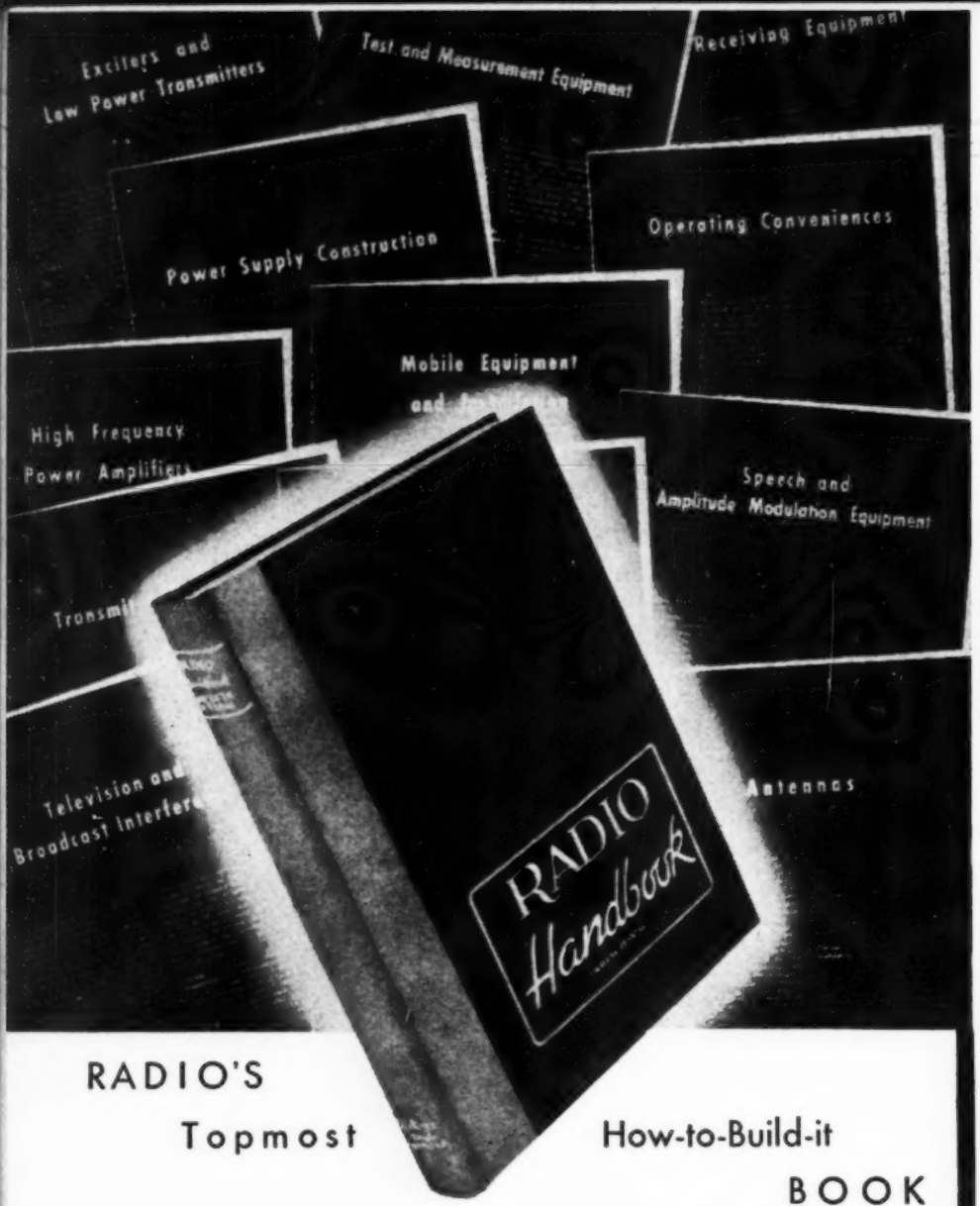

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$3.00 per copy clothbound AT YOUR FAVORITE DEALER in U.S.A. Please add 25c. to U.S.A. mail orders (plus tax in Calif.); foreign, 50c. (12th edition will be sent on all orders unless 11th edition is specified.)

Editors and Engineers 1102 KENWOOD ROAD Santa Barbara CALIFORNIA

nicians' school at no cost to the servicemen for the purpose of developing and training technicians in the State of Indiana. The plan was to make it possible for television to be merchandised in this area with a minimum of service problems.

* * *

GEORGE K. KONZ has been appointed assistant manager of advertising and sales promotion of the *National Union Corporation* of Orange, New Jersey. Mr. Konz, who currently lives in Madison, New Jersey, was assistant director of public relations for the *American Insurance Company* of Newark before joining *National Union's* advertising department. . . . **MARSHALL J. MURPHY** will be the general superintendent of all departments for *The Wheeler Insulated Wire Company.* Previously associated with *The Acme Wire Company* and *The Easton Coil Company,* Mr. Murphy joined the *Wheeler* organization in 1929 as departmental superintendent. . . . Succeeding T. R. Mathews, **JUSTIN L. ALBERS** was appointed a *Stromberg-Carlson* district merchandiser and will contact distributors in St. Louis and the Southwest.

* * *

CRYSTALX CORP. is the new name of the firm of *Croasdale & DaAngelis, Inc.,* it was announced recently. The Lenni Mills, Pa., firm of plastic fabricators also stated that E. B. Westlake, Jr., will be the new sales engineer. . . . **N. E. W. A.** has changed its name to National Association of Electrical Distributors, and will hereafter be referred to as N. A. E. D. The Association's board decided that the economic functions of the modern distributor of electrical apparatus, supplies, and appliances would be reflected by the new name.

* * *

SPEER CARBON COMPANY of St. Marys, Pa., has acquired the *Speer Resistor Corp.* and *Jeffers Electronics, Inc.,* adding a number of products to its line.

According to the announcement, no change in the management of either company is contemplated at present. The *Speer Carbon Company* will, with the acquisition, carry a more complete line of fixed carbon resistors, iron cores, coil forms, coils, condensers, and trimmers.

* * *

LOUIS W. HATRY, as president of NEDA, has made the announcement that the time and place of the next regular meeting of the NEDA board of directors will be Saturday and Sunday, October 8 and 9, at the Cleveland Hotel, Cleveland, Ohio.

The gathering on October 9 will be an open meeting, to which 75 NEDA members whose business affairs are carried on in that area have been invited to attend as guests.

It is expected that many manufacturers doing business with parts distributors are expected to visit Cleveland to meet their distributors attending the NEDA board meeting. —30—

The NEW SANGAMO Type 30 TUBULAR CAPACITOR

Long Life...

UNDER SEVERE CONDITIONS

Three years ago Sangamo successfully pioneered the FIRST molded tubular capacitor. The experience gained in these three years is now applied by new effective manufacturing methods, and proven by special exhaustive tests which invariably exceed the requirements of actual service conditions. Thus, the Type 30 you purchase today offers positive promise of exceptional long life under severe conditions.

85° C Performance: Excellent. Trouble-free long-life operation in spite of the high temperatures encountered in auto radios, television receivers, or any other application where high temperatures cause trouble.

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Mechanical Strength: Excellent. Leads resist breaking or pulling out, even when handling is extremely rough.

Remember this about Sangamo Type 30 Tubulars: They are molded at *low* pressure. This means their elements are undamaged in fabrication. It also means longer life, greater dependability, and the absence of "hot spots." A trial of Sangamo Molded Tubulars will convince you!

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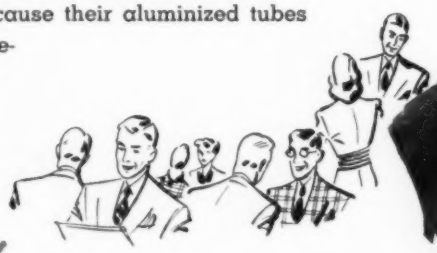
"I can't afford not to handle the Rauland Line"...

Says Peter Chanko, popular President of the New York Chapter of NEDA, and head of Chanrose Distributors, Jamaica, New York.

... "because Rauland is always ahead of the rest of the industry in new picture tube developments, because their aluminized tubes have better contrast and definition, because rejects and returns are at a minimum and because Rauland's policies protect us and allow a fair margin of profit."



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Your customers see the difference instantly. They see the sharpest picture they've *ever* seen ... better contrast ... and up to 80% brighter when VISITRON replaces a standard tube. Brighter even in bright daylight without shades drawn! (Very important now with daylight saving and daytime sports.) VISITRON's remarkable *aluminizing* process makes the miracle difference!

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With VISITRON, you can make more replacement sales. And VISITRON cuts your overhead as well—saves time and work—no adjusting of magnets, no rewiring. All you do is plug 'em in!

3 Boosts Filter Sales, Too!

You can recommend a filter without hesitation—without the usual risk of return—when you install a VISITRON picture tube. Only the *extra* brilliance of this aluminized tube can carry a bright, sharp picture clear through even a heavy filter—no dim, fuzzy image as with ordinary tubes.

10 WAYS BETTER

1. More brilliance
2. Better contrast
3. Better definition
4. Greater fidelity
5. No ion spot
6. No cathode glow
7. No magnet
8. No circuit problem
9. Replaces any magnetic tube
10. Any filter can be used

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He finds trouble by ear

As this cableman runs his pickup coil along the cable, his ear tells him when he has hit the *exact spot* where unseen trouble is interfering with somebody's telephone service.

Trouble develops when water enters a cable sheath cracked perhaps by a bullet or a flying stone. With insulation damaged, currents stray from one wire to another or to the sheath. At the telephone office, electrical tests on the faulty wires tell a repairman approximately where to look for the damage.

A special "tracer" current, sent over the faulty wires, generates a magnetic field. Held against the sheath, an exploring coil picks up the distinctive tracer signal and sends it through an amplifier on the man's belt to headphones. A change in signal strength along the cable tells the exact location of the "fault."

Compact, light, simple to use, this test set makes it easier for repairmen to keep your line in order. It is another example of how Bell Laboratories research helps make Bell Telephone service the most dependable in the world.

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Exploring and inventing, devising and perfecting, for continued improvements and economies in telephone service.

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SYLVANIA

Sylvania 6-way Mahogany Console Combination # 128.
12½" tube... AM-FM radio...3-speed automatic record changer.

Sylvania 16" Mahogany Console # 090.
16" tube . . . FM sound . . . plug-in for record player.

Sylvania 6-way Mahogany Console Combination # 076.
10" tube . . . AM-FM radio . . . 3-speed automatic record changer.

Sylvania 12½" Mahogany Console # 114.
12½" tube . . . FM sound . . . plug-in for record player.

SEE the difference in SYLVANIA MOVIE CLEAR TELEVISION!

Sharper contrast! Finer detail! Sylvania's "Needle-Point" electron beam *brings out more detail more clearly!* **Steadier pictures!** New Sylvania "Triple Lock" makes pictures stay put, stay rock-steady *even under adverse conditions!* **Minimum picture interference!** Sylvania's shielded "Coaxial" lead-in eliminates "picture static."

HEAR the difference in SYLVANIA MOVIE CLEAR TELEVISION!

FM high-fidelity circuits with wide-range speaker and "Audio-Balanced" tone control! **"Intercarrier Sound"** eliminates "howls," "microphonic noise," and "acoustic feedbacks"! **Sound locked in with picture!** Sound automatically maintains its volume and quality no matter how often you switch channels!

COMPARE—
Close your eyes and compare Sylvania FM sound with the sound of any other fine television set!

MOVIE CLEAR* TELEVISION

MORE PROFITS FOR YOU!

Sylvania 10" Mahogany Console # 113.
10" tube . . . FM sound . . . plug-in for record player.

Sylvania 12½" Mahogany Table Model # 125.
12½" tube . . . FM sound . . . matching table optional.

Sylvania 10" Mahogany Table Model # 075.
10" tube . . . FM sound . . . matching table optional.

Sylvania 10" Blonde Table Model # 124.
10" tube . . . FM sound . . . matching table optional.

The Most Sellable Television on the Market— that's SYLVANIA MOVIE CLEAR TELEVISION!

Styled right for you and your customers! A model to please every customer, every model's a fast-mover! Keeps inventories low!

Priced right for you and your customers! Low prices for big sales—high markup for big profits!

Sensational new "Pay-back" service contract! Exclusive Sylvania contract gives your customers *cash refunds* for service they don't use! That's a powerful selling tool—exclusive with *Movie-clear* Television!

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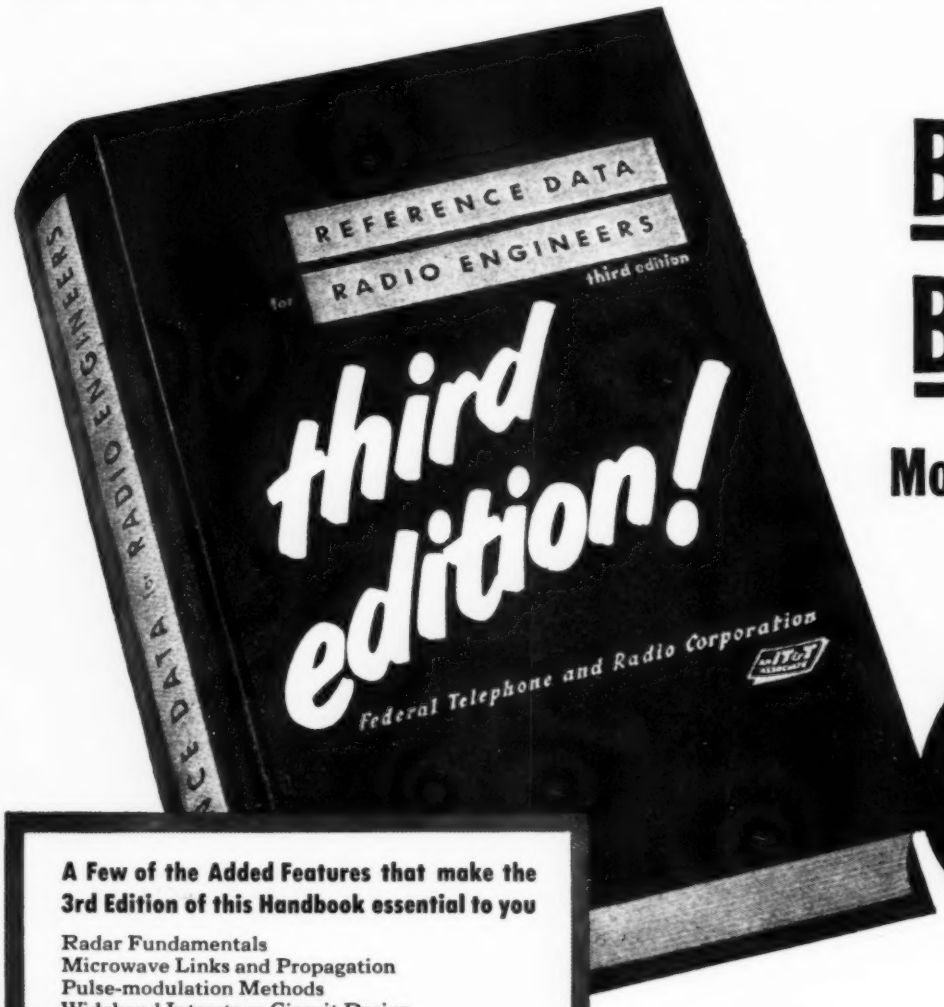

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The TV FREEZE and ULTRA-HIGH FREQUENCIES

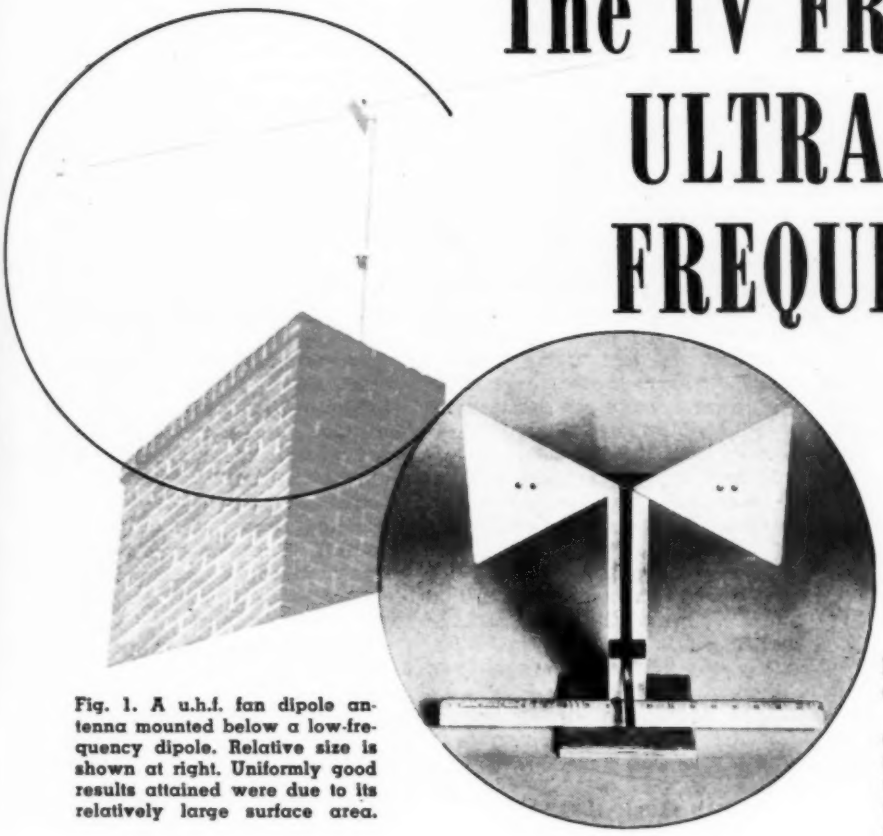


Fig. 1. A u.h.f. fan dipole antenna mounted below a low-frequency dipole. Relative size is shown at right. Uniformly good results attained were due to its relatively large surface area.

By
M. S. KAY

FCC to end TV freeze soon—42 u.h.f. channels to be added. How will this affect you? It will mean new problems — new installation techniques, test equipment, antennas, et cetera.

THE television broadcast industry has been operating under a "freeze" order issued by the FCC since September, 1948. The "freeze" order stated that no new TV station construction permits would be authorized until further data had been secured concerning the reduction or elimination of interference among television stations which had recently been noted. This order did not affect the 35 stations then in operation or the 89 construction permits which had already been issued.

The original station allocations for the metropolitan areas of the United States, as set forth by the FCC, separated most stations assigned to the same channel by at least 150 miles, although, in a few instances, the separation was closer to 100 miles. These distances were considered sufficiently great to prevent the signals of one station from causing interference to any other station operating on the same frequency. As more and more stations appeared on the air, however, it was found in some instances that even distance separations in excess of 150 miles did not prove sufficient, and that sets located at points between the stations received both signals with enough strength to render either signal useless. This in spite of the fact that one of the stations was usually more than 75 miles away.

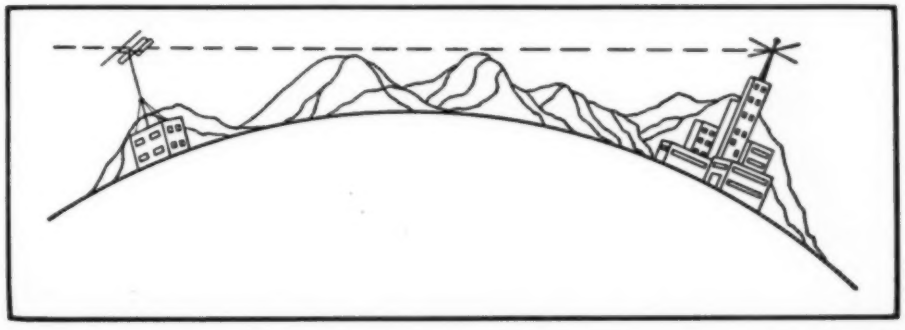
The situation, if permitted to continue, gave promise of bogging down the entire television industry in a morass of interfering signals which would do much to alienate the public's desire for television. Coupled to this condition was the increasingly vocal demand for more channels by the broadcasting industry. Since additional channels under the present allocation plan were obviously unthinkable, the FCC decided that now was a good time to settle both problems and clamped on their "freeze" order.

In order to understand why co-channel station separation of 100 miles or more is not always adequate, we must examine the methods by which high-frequency waves travel through space. High-frequency signal propagation can be divided into three categories, each one of which is responsible for the reception of these signals by a different means.

First, there is the so-called "line-of-sight" method whereby the waves travel in a straight line from transmitter to receiver. This represents the chief means of communication for frequencies above approximately 40 mc. Secondly, there is diffraction or slight bending around the curvature of the earth; and lastly, there is refraction or bending in the air just above the ground, known as the troposphere. This latter method of wave bending is quite different from ionospheric refractions which make long distance communication possible at frequencies below 40 mc. and is responsible for many of the foregoing difficulties.

The three methods are generally independent of each other. The last two

Fig. 2. Line-of-sight transmission.



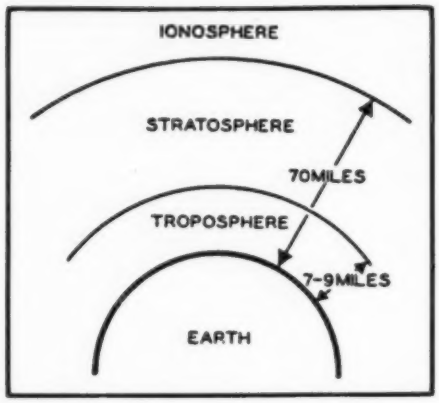


Fig. 3. Composition of the earth's atmosphere.

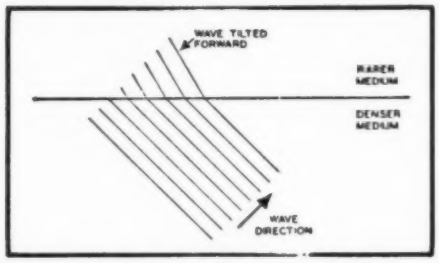


Fig. 4. If a wave travels from a denser to a rarer medium, the wavefront tilts forward.

modes of propagation are responsible for signals appearing beyond the horizon, while the first method deals with distances such that the receiving and transmitting antennas are in a direct line above the curvature of the earth.

Line-of-Sight-Method. Little need be said about the line-of-sight propagation since most television men are familiar with it. It is illustrated in Fig. 2 and is governed by the relationship

$$d = 1.23\ (\sqrt{h_t} + \sqrt{h_r})$$

Where d is the distance between antennas in miles
h_t is the transmitting antenna height in feet
h_r is the receiving antenna height in feet.

Wave Diffraction. A second means of high-frequency wave travel is by diffraction. To illustrate diffraction, consider light waves. So far as is popularly known, light seems to travel in straight lines. Ask most people whether it is possible for light to bend around a corner, and the answer will invariably be no. Ask the same question about a sound wave, and the opposite reply will be obtained. The reason for one and not the other stems from the observed fact that, where the wavelength of the wave being transmitted is comparable to or larger than the size of the obstacle in its path, the waves will be bent or diffracted around this object. However, as the wavelength gets smaller and smaller, less and less bending occurs until at the very minute wavelengths of light, none seems to be present with any ordinary sized objects. However, even here it has been demonstrated that if light from a distant source is sent through a narrow slit, the pattern obtained on the other side of this opening will show that the light did bend in going through. Thus, it is a matter entirely dependent on the relative sizes of the wave and the obstacle in its path. Since the ultra-highs are longer in wavelength than light rays, some bending does take place. The bending, then, is responsible for the fact that the ultra-high signals are received at points beyond the line-of-sight distance. The waves follow the curvature of the earth for a short distance beyond the ordinary direct ray path of the radio signal. Naturally, as the frequency is increased and the wavelengths decreased, less and less bending will occur.

The diffraction effect is independent of weather variations, and for short distances beyond the horizon the signals are steady in intensity and can be relied upon for continued use. However, the phenomenon of diffraction increases the distance of propagation only slightly. By far the more important reason for relatively long distance high-frequency transmission depends on the refraction effects in the lower regions of the air just above us. These effects are not independent of the weather; on the contrary, they are present because of a certain set of conditions in the masses of air that give us what we call weather.

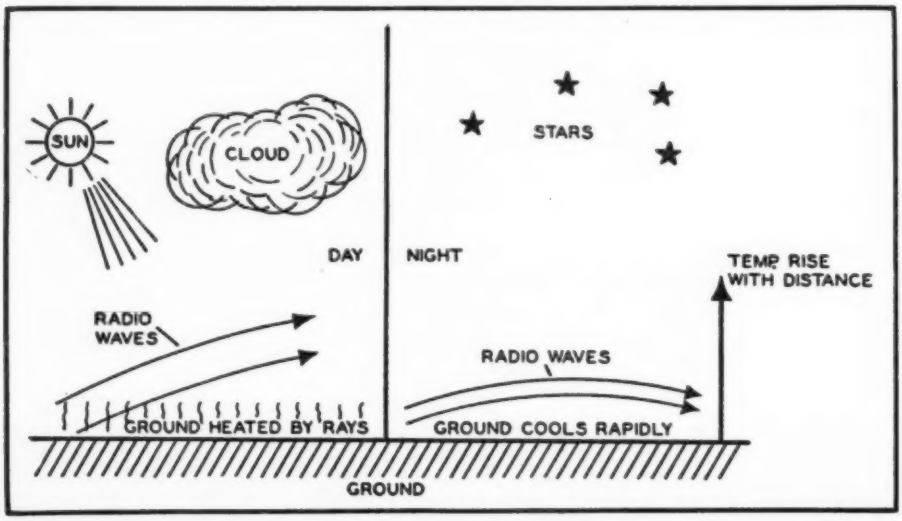
Refraction in the Troposphere. The layers of air surrounding the earth may be divided into three fairly distinguishable categories. In direct contact with the ground is the layer that contains the air we breathe. This is the troposphere and in this region most of the weather conditions take place. See Fig. 3. It extends above the ground for a distance of 7 to 9 miles. Above the troposphere is the stratosphere where the air is extremely rarefied and where the atmospheric pressure is low. This region is seldom affected by changing weather conditions; the same, unchanging calm prevails the year around. This region starts where the troposphere ends and continues until the ionosphere is reached, about 70 miles above the earth. The ionosphere, as is well known by now, is responsible for the return of the low-frequency waves to the earth's surface.

To understand how the extremely short waves are refracted or bent back to earth in the troposphere, it is necessary to know that in order for a transmitted radio wave to bend back to earth, several conditions must be present. First, the velocity of the wave must increase as it travels into regions that are less dense. When this prevails, that part of the wavefront entering the rarer medium will have its velocity speeded up, while the remainder of the wave is traveling at the slower speed in the denser medium. The result, as shown in Fig. 4, is that the wave is tilted forward. This action usually affects waves of every frequency traveling upward through the thinning atmosphere, but is not, in itself, sufficient to return the waves to the earth.

Secondly, it has been demonstrated experimentally that the velocity of a wave will increase if it travels into a region of increasingly higher temperatures. Now if both of these conditions (higher temperatures and decreasing atmospheric pressure) occur at the same time, it is possible for a wave to be bent sufficiently to return to earth. It might be wondered where these two conditions could occur, since it is common knowledge that as the atmospheric pressure goes down (with increase in distance above ground), the temperature likewise decreases. This latter combination is the opposite of that desired, and represents the normal situation. Quite frequently, however, other conditions occur which are contrary to the usual run of things and which provide the desired combination, namely, decreasing atmospheric pressure and increasing temperatures.

Take, for example, a clear day during which the sun beats down fairly steadily. There is but little absorption of heat as the rays pass through

Fig. 5. Conditions producing refraction of high-frequency signals in the troposphere.



the atmosphere, and the air is only slightly heated. The ground absorbs most of the heat and consequently rises to a comparatively high temperature. After sundown, the ground starts to cool. Then, if the process occurs quite rapidly and to a large degree, it is quite possible that the air above the ground will, after a short period, be warmer than the cooled-off ground. While the ground is becoming cooler, so is the air, but at a much slower rate. A condition is therefore obtained where the temperature increases with height. This will aid the refraction of short waves and, as shown by Fig. 5, will result in the reception of signals at points below the horizon which the direct rays cannot reach. The weather conditions that give rise to the desired temperature inversion (increase in temperature with height) occur most frequently in summer, when the sun is hot during the day and the sky is clear at night.

Air Masses. Tropospheric interference is not confined to the summer, however. There are still other conditions that will produce increasing temperatures with height. The temperature inversion is brought about by the air masses that travel across the country from the Pacific to the Atlantic. If the air masses originate in or get their characteristics from the north, cold, clear weather may be expected. It is this kind of air mass that is responsible for the extreme cold that is encountered frequently in the winter. There is another kind of air mass that may be formed in the warmer climates and which will result in soft, balmy weather, mixed with showers. Such masses of air are sometimes responsible for the hot, oppressive heat in the summer when they become stagnant over one portion of the country. In winter they cause what is known as unseasonable weather. Both are distinct from each other and may occur at any time. These large air masses are continually on the move in an easterly direction (Fig. 6) although it happens from time to time that they remain in one place for several days.

Quite frequently a warm air mass moving forward encounters a cold mass of air. The denser, cold air will stay close to the ground while the warm mass of air will be pushed upward. The line separating the two is distinct and tends to remain so because there is very little mixing. This situation is shown in Fig. 7, with the arrows pointing in the direction of movement of both the cold and warm air masses. Notice, also, that the line separating the two types of weather is not vertical but tends to assume an angle with the ground. The result of this contact between the air masses has produced a temperature inversion. The warm air is now higher above the ground than the cold air. High-frequency waves coming up through the cold air from the transmitting antenna on the ground will

DIGEST OF FCC PROPOSALS TO END TV FREEZE

(Final hearings scheduled to be held in September)

On July 11, the FCC issued a list of rules and standards concerning the allocation of stations in the v.h.f. and u.h.f. region. While only tentative and subject to change pending the outcome of further hearings, the proposals as set forth in the FCC release are expected to be adopted substantially as released. The following are the major points listed.

1. In addition to the twelve v.h.f. six mc. channels already allocated (numbered 2 through 13), there will be added forty-two six mc. channels to be numbered consecutively, Channels 14 through 55.

2. Channel 14 will begin at approximately 470 mc. or 500 mc., depending upon what action is taken by the Commission with respect to the request of the *Bell Telephone Laboratories* for space in the u.h.f. band for a broad-band system of mobile communications.

3. Thirty-two of the additional channels will be used for metropolitan stations while the top ten will be reserved for community stations.

4. The engineering standards for all channels will remain as they are at present.

5. Consideration will be given to proposals for a change in transmission standards on Channels 2 through 55 looking toward *color television* or any other television system, provided:

a. Such systems can operate in a six megacycle channel; and

b. Existing television receivers will be able to receive signals under the new system simply by making relatively minor changes.

6. Metropolitan stations will be authorized to operate within the following power limits with an antenna height of 500 feet.

Channels	*Minimum*	*Maximum*
2-6	10 kw.	100 kw.
7-13	10 kw.	100 kw.
14-55	10 kw.	200 kw.

7. Wherever possible, co-channel separation for metropolitan stations on the v.h.f. band is 220 miles and adjacent channel separation, 110 miles. On the v.h.f. channels, the spacing is 200 miles for co-channel stations and 100 miles for adjacent channels. For community channels, the spacing is about 140 miles.

8. There is set forth a complete listing of the v.h.f. and u.h.f. channels allocated to cities throughout the United States. 1329 communities receive one or more v.h.f. channels. 207 communities receive one or more u.h.f. channels. Prior to these proposals, only 131 communities in the entire country were allocated television channels.

9. As a general rule, v.h.f. channels are assigned to large cities. U.h.f. channels go to smaller communities. In some places, however, both u.h.f. and v.h.f. channels are permitted.

10. It is the professed aim of the FCC:

a. To provide at least one television service to all parts of the United States.

b. To provide each community with at least one television broadcast station.

c. To allocate the remaining unassigned channels to the various communities according to their size, geographical location, and the number of television services available to them.

11. The top fifty markets come out in the proposed new allocations, as follows:

a. Twenty-five are to retain the same number of v.h.f. channels. These are: Atlanta, Baltimore, Birmingham, Chicago, Dallas, Dayton, Denver, Houston, Kansas City, Los Angeles, Louisville, Memphis, Milwaukee, New Haven, New Orleans, New York, Omaha, Portland, Ore., Providence, San Antonio, San Francisco, Seattle, Syracuse, Toledo, and Washington.

b. Boston, Buffalo, Cincinnati, Cleveland, Columbus, Detroit, Philadelphia, Norfolk-Newport News-Portsmouth area, Richmond, and San Diego are to lose one v.h.f. channel.

c. Akron, Allentown-Bethlehem-Easton area, Lowell-Haverhill-Lawrence area, Scranton-Wilkes-Barre area, Springfield-Holyoke area, Youngstown, and Worcester are to lose the only single v.h.f. channel formerly allocated them.

d. Indianapolis, Hartford-New Britain area, Pittsburgh, and Rochester will lose two v.h.f. channels each.

e. Albany-Schenectady-Troy area will lose four v.h.f. channels.

f. St. Louis gains one v.h.f. channel.

g. Indianapolis, St. Paul, and Miami are to gain two v.h.f. channels.

h. U.h.f. channels will go to the following (in top fifty market areas): One each to Buffalo, Indianapolis, Philadelphia, Portland, and Washington. Two each to Atlanta, Albany-Schenectady-Troy area, Allentown-Bethlehem-Easton area, Baltimore, Cincinnati, Cleveland, Dayton, Detroit, Louisville, Lowell-Haverhill-Lawrence area, New Haven, Norfolk-Newport News-Portsmouth area, Pittsburgh, Providence, Seattle, Scranton-Wilkes-Barre area, Springfield-Holyoke area, San Diego, Toledo, and Worcester. Three each to Akron, Hartford-New Britain area, Richmond, Rochester, and Youngstown.

i. Balance of the top fifty areas (twenty) will remain solely v.h.f.

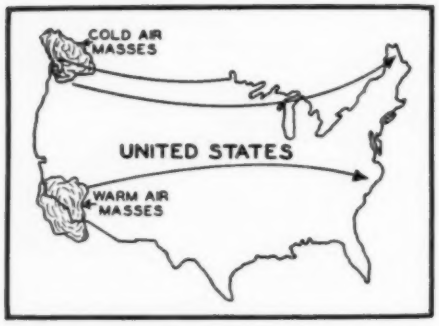


Fig. 6. General routes taken by the air masses in traveling across United States.

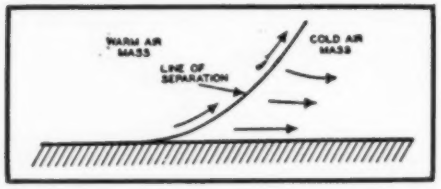


Fig. 7. A warm air mass, having overtaken a cold front, will always rise above it.

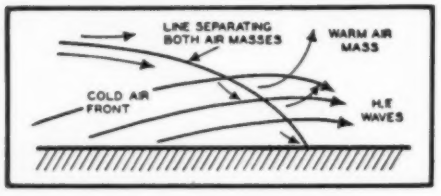


Fig. 8. Direction of movement of warm air mass when overtaken by a cold air mass.

meet the warmer temperatures above and be refracted earthward. At 100 mc., transmission of signals has been obtained over distances as great as 500 miles. The amount of bending that occurs depends upon several factors, such as:

(1) Sharpness of the line separating the cold from the warm air, (2) Height of this line of separation above the ground, and (3) Angle which this line makes with the earth.

Should a cold mass of air be moving forward and then be overtaken by a mass of warm air, the conditions shown in Fig. 8 can occur. The lighter, warm air will again rise above the cold air and again a temperature inversion occurs.

The effect of the foregoing conditions on television reception has been to produce considerable interference in receivers in some localities located in fringe areas. The most notable of such interference occurs when the carriers of two stations operating at the same frequency are received. One such trouble area is found in central New Jersey where the signals from WNBT, New York, are received together with those from WNBW, Washington, D. C. Both stations operate on Channel 4, and throughout the area both signals arrive with sufficient strength to cause interference.

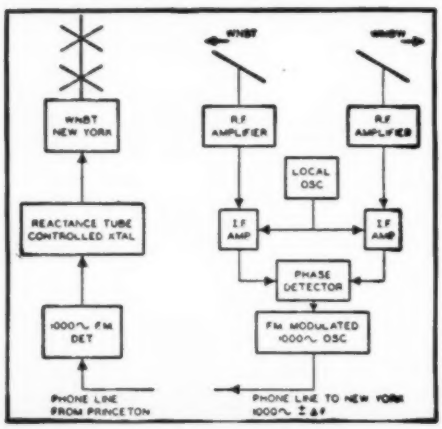
The visual consequence of this interference is a series of black-and-white bars appearing across the screen. As the two carrier frequencies come closer together, the number of interference bars decreases until the carrier beat frequency reaches 60 cycles. At this point there is one large black bar and one large white bar. As the beat frequency decreases below 60 cycles, the brightness of the picture is affected, resulting in a slow, annoying flicker. If, however, the two carriers are locked into some fixed phase relationship with each other, the flicker disappears.

Co-channel interference has, to date, been encountered to any large extent in two areas, the one just mentioned and at various points between Detroit and Cleveland. To prevent additional trouble areas from developing as more stations came on the air, the FCC last September suddenly clamped on their "freeze."

The problem of reducing the interference can be solved in three ways; by increasing the physical distance between stations operating on the same channel; by employing some method to synchronize the carriers of the interfering signals; or by the offset carrier method.

A carrier synchronization method has been developed by R. D. Kell of *RCA*, by which the carriers of interfering co-channel stations are locked in a fixed phase relationship with each other, and all flicker is removed. A block diagram of the circuit is shown in Fig. 9. A receiving post or station is set up at some point between the interfering stations, and each of the carriers is received independently. Two separate receivers are used, one connected to a directional antenna oriented to receive, say, WNBT, and the other receiver connected to an antenna oriented to receive WNBW. The same local oscillator feeds both receivers so that any phase differences between the signals is not altered or disturbed. The signals are then amplified independently by their respective i.f. systems and fed to a common phase detector. A direct voltage is produced here, its magnitude and polarity dependent upon the phase difference between the two carriers. This direct voltage is used to modulate an FM oscillator operating at 1000 c.p.s. The signal is then transmitted over an ordinary telephone circuit to WNBT, New York, where it is demodulated to recover the direct voltage variations originally developed at the output of the phase detector. The direct voltage is applied to a reactance tube connected across the crystal control of the WNBT video transmitter, and the frequency of this station is locked into synchronism with that of WNBW.

Fig. 9. A carrier synchronization system designed to eliminate co-channel interference between television stations.



With the foregoing system, it is claimed that interference-free reception can be achieved when co-channel stations are separated by as little as 150 miles. Without such synchronization, the separation distance would have to be increased to 225 or 250 miles, which would mean fewer television stations.

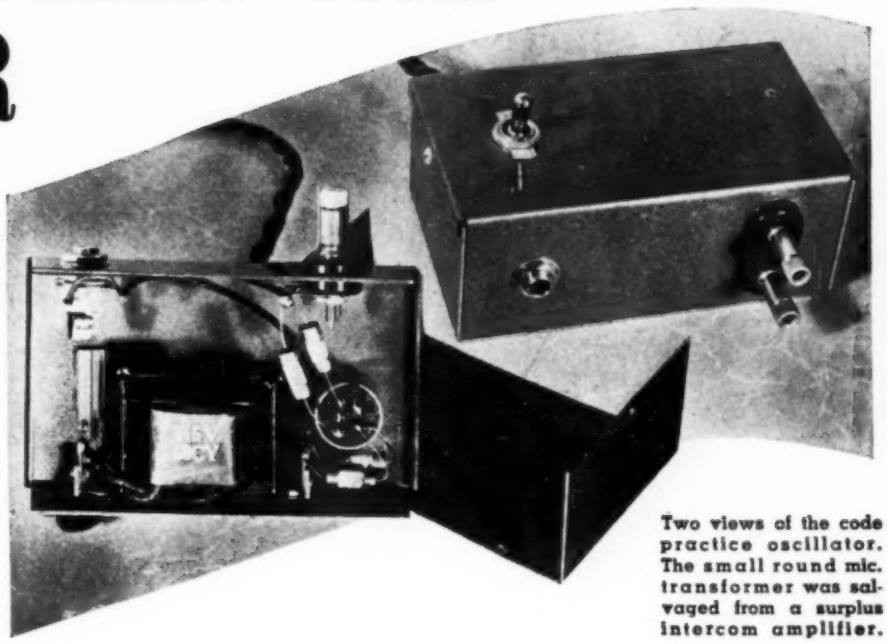
To answer the demand for more television channels than were provided by the original allocation plan and, at the same time, keep interference between stations to a minimum, it is expected that the FCC will shortly remove the freeze and announce the allocation of television channels in the u.h.f. band, 475 to 890 mc. Whether or not the commission will avail itself of the carrier synchronization method (or some similar arrangement) to permit co-channel stations allocations to continue under the original plan, or whether stations will be separated by a minimum of 225 miles, is still in doubt. However, with the opening of the u.h.f. band, it is believed that enough stations could be accommodated to make even the increased distance separation feasible without too much complaint from the broadcasting industry.

The allocation of television stations in the u.h.f. region is of the utmost importance to the television technician because upon him will fall the responsibility of properly installing sets at these frequencies. Of primary importance, at the outset, will be the propagation characteristics in the u.h.f. region and what the television antenna installation man may expect to encounter. While at the present writing there has been no extensive installation of u.h.f. television receivers, tests have been conducted by *RCA, DuMont,* and others, resulting in many definite conclusions.

In the u.h.f. television band, 475-890 mc., the electromagnetic waves transmitted by the broadcast station possess a smaller wavelength than the waves employed for Channels 2 to 13. Now it was previously stated, in explaining the phenomenon of diffraction, that bending of waves around objects would occur if the length of the wave was close to or greater than the size of the object. However, in the u.h.f. region, the wavelength varies from approximately 25 inches (at 475 mc.) to 13 inches (at 890 mc.). The net result of the wavelength decrease means that less diffraction will occur, and therefore obstructions such as

(*Continued on page* 126)

A Novel TUBELESS TONE GENERATOR



Two views of the code practice oscillator. The small round mic. transformer was salvaged from a surplus intercom amplifier.

By
RUFUS P. TURNER, K6AI

A new crystal-diode type of code oscillator which produces even multiples of an applied signal.

A SIMPLE, frequency-multiplier-type tone generator can be made by cascading (through transformer coupling) several full-wave rectifiers. Since only diodes are used, the circuit is not complicated. By employing crystal diodes, no power is required except that derived from the input signal. The input signal may be supplied by the 60 cycle a.c. power line.

With the addition of a small 6.3 volt filament transformer, the crystal diodes may be eliminated and tubes available at low cost on the surplus market may be used. Either triodes, connected as diodes, or the smaller diodes, such as the 6AL5 or 6H6, may be used. Twin triodes with a common cathode may be used.

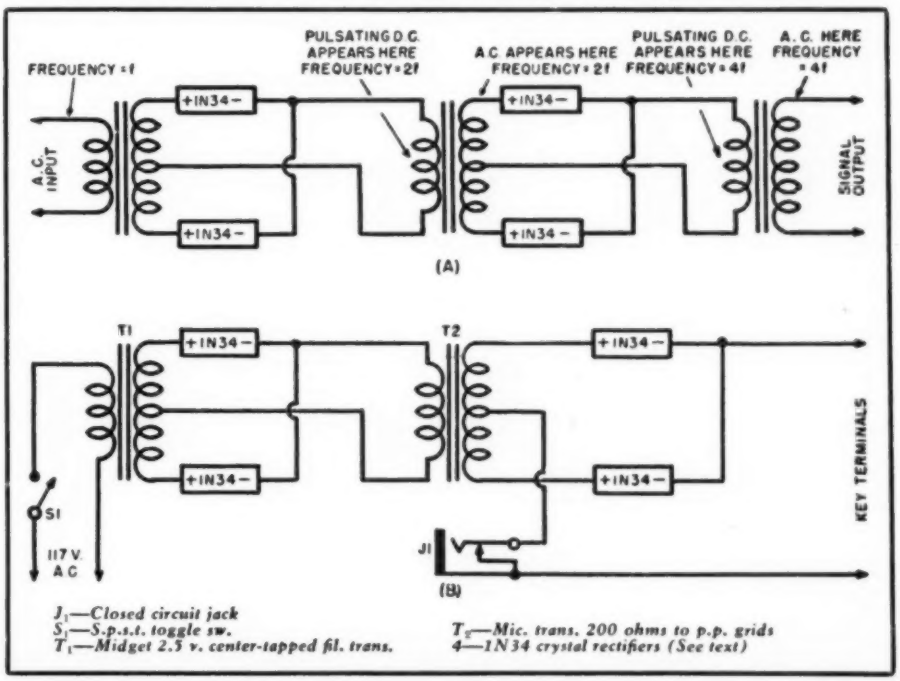
Operation of the circuit is based upon the well-known fact that the d.c. ripple in the output of an unfiltered full-wave rectifier has a frequency equal to twice that of the applied a.c. voltage. This ripple is a pulsating d.c., but it may be fed into the primary of a transformer to be changed back to a.c. in the secondary. The result is a simple frequency doubler. The secondary a.c. voltage then may be applied to a second full-wave rectifier and transformer and its frequency doubled by the same kind of action. The initial frequency then will be quadrupled. The process may be repeated in successive doubler stages to give various even multiples of the initial frequency (times 2, 4, 8, 16, 32, etc.). The scheme will work at radio frequencies as well as at a.f.

Fig. 1A illustrates the principle and shows the circuit arrangement of two stages. Output jacks or terminal posts might be connected across the secondary of the first transformer to give output at the input frequency *f*, and across the secondary of the second transformer to give *2f*. The output terminals of the second stage give output at frequency *4f*. Thus, when a 60 cycle voltage is applied to the input terminals of the circuit, the first jack will yield 60, the second 120, and the output terminals, 240 cycles.

Since there is some unavoidable power loss in each stage, the final output will be somewhat less than the input. However, a large input voltage may be used (so long as the crystal ratings are not exceeded), thereby making it possible to carry out the frequency multiplication to a rather high order before the output finally becomes too small to be useful. The output waveform is smooth and rounded (in contrast to the sawtooth waveform obtained with other tubeless generators), although it is not the true sine wave which it approaches. This will be only of minor concern in applications where the tone frequency itself, rather than absolute purity of waveform, is the prime goal. The relative expense of crystal diodes and transformers in a tone generator of this kind is offset by the freedom from power supplies, instant operation afforded by absence of filaments, compactness, freedom

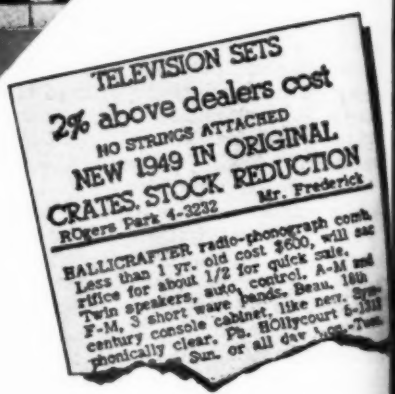
(*Continued on page* 115)

Fig. 1. (A) Principle of the tone generator. (B) Diagram of code practice oscillator.



WE DON'T CARE WHO YOU ARE
OR WHERE YOU ARE EMPLOYED
WE GIVE TOP DISCOUNT to All (Except on Fair Trade Items)
TELEVISION
(Except on Fair Trade Items)

This type of advertising is familiar in the television field, yet you will notice the exception made in referring to Fair Traded items. Would the Fair Trading of most makes of television receivers eliminate or minimize price cutting in the television field? This is the question discussed by the author in the article.


TELEVISION SETS
2% above dealers cost
NO STRINGS ATTACHED
NEW 1949 IN ORIGINAL
CRATES. STOCK REDUCTION
ROgers Park 4-3232
Mr. Frederick
HALLICRAFTER radio-phonograph comb.
Less than 1 yr. old cost $600, will sac
rifice for about 1/2 for quick sale.
Twin speakers, auto. control, A-M and
F-M, 3 short wave bands. Beau. 18th
century console cabinet, like new. Spec
tacular phonically clear. Pk. Hollycourt 5-1313
Sun. or all day

Is Fair Trade The Answer To TV Price Cutting Problem?

By CARLE CHRISTENSEN
Sales Consultant

Other industries have proven beyond a doubt that Fair Trading reduces cut-throat price cutting.

THERE is little doubt but that price cutting is the number one problem facing the television dealer today. As the department manager of one of the country's leading department stores put it recently: "We can't afford to handle television receivers in the current market. We're seriously considering discontinuing their sale.

"Just about everyone who comes into this department talks in terms of a discount of from 15 to 30 per-cent that they have been quoted by some dealer. With overhead, personnel, and advertising, it costs us 30 to 35 per-cent to handle an article. So how can we possibly afford to continue handling merchandise that must be sold in the face of cut-throat competition that is working on a margin of from two to twelve per-cent above cost?"

Or consider the comment of a small appliance dealer. Asked if he felt the pressure of price cutting, he answered, "Feel it? Are you trying to be funny? If someone were to come in that door and offer to buy a television receiver without asking for a discount, I think I'd drop dead of surprise!

"They usually tell me quite frankly where they can buy it for about what I pay for it. So what can I do? Chase them out the door? Oh no! I bargain and use all the salesmanship I can.

"But don't kid yourself, it's tough going; because regardless of how much salesmanship I use, the prospect still knows the dealer down the street will give him the same set at a discount. So I usually end up giving him a discount, too, or a free installation—or sometimes both."

The problem of price cutting is not a new one. It has been faced in recent months and years by every major industry as the sellers' market has changed to a buyers' market.

In many industries, such as the drug field, the photographic field, and the liquor field, price cutting has been kept under control—at least to the extent that there is no cutrate advertising, and the great majority of sales are made at list so that the dealers are able to operate on a normal margin of profit that permits sound growth and adequate servicing.

Yet, in the field of television, price cutting has grown to such proportions that millions of dollars in profit have been lost, and good will forfeited, creating a wide-spread uncertainty in the minds of the general public as well as the dealers as to its future. To quote a recent statement issued by the Philadelphia Retail Merchant's Credit Association, "Discount selling in the television field has reached such proportions that it is not only a menace to the new industry, but it is also detrimental to all retailing."

What has brought about such a difference between these two pictures? What have the drug, photographic, and liquor industries done that the television industry has failed to do? And could the same solution that has been successful in minimizing price cutting in these other fields be applied in the television field as well?

It is very obvious that a retail merchant must make a profit to stay in business, and the only way he can do this is to sell his merchandise or services at more than they cost him.

Uncontrolled, unwarranted price cutting will not allow him to do this. What might normally be a thriving, successful business can very rapidly go on the rocks if everything must be sold at a discount. Only as the leech-like influence of discount selling is eradicated will a healthy retail operation be possible in the television field.

As was mentioned before, other major industries have at one time suffered from the same blight of indiscriminate price cutting that now plagues television. Yet today, they are in a continually improving position which permits them to sell the greater part of their stock at list prices, upheld and protected by agreements between dealers and manufacturers. This has been made possible by the Fair Trade laws of their respective states and the Miller-Tydings Amendment to the Sherman Anti-Trust Act.

In all of our United States, except for Missouri, Texas, Vermont, and the District of Columbia, Fair Trade laws have been passed which permit the manufacturer of a product "which is in open competition with commodities of the same general class produced by others" to enter into contracts with dealers (or wholesalers) to sell the product at the price named by the manufacturer. Moreover, in many states, not only the manufacturer, but a vendor, who has exclusive distribution, coupled with a sufficient interest, tantamount to ownership, may Fair Trade a product.

In either case, however, once a price has been established under Fair Trade, it becomes binding on *all* dealers, whether they have signed the contract or not, and if, thereafter, they willfully and knowingly advertise or sell such a commodity at less than the specified price, it is unfair competition, permitting legal redress by an injured party.

To illustrate: Let us suppose (as is the case in Chicago) one of the distributors has established a line of television receivers at certain list prices, under Fair Trade laws. Let us further assume (as has occurred) that a dealer advertises or is known to have sold one of these sets at less than the agreed price. What happens? An injunction is immediately obtained restraining the dealer from making any further cut-price sales, and should he continue, he is open to punishment for contempt of court. Some courts punish for contempt by fine, and some by imprisonment. Resort to court action is, however, seldom necessary in enforcing Fair Trade regulations.

Or let us take a recent case in the photographic field. Mr. Justice Walter, in the Supreme Court for New York County, recently handed down a permanent injunction against a dealer who used phrases such as "store demonstrator" and "like new" as a subterfuge to permit him to sell Fair Traded products at less than list.

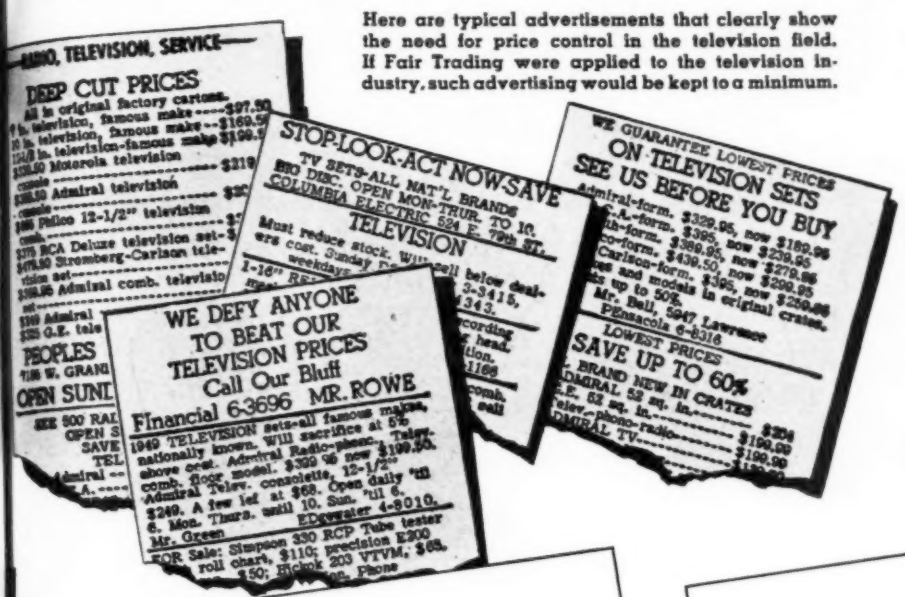
Justice Walter spoke of such practices as being "nothing more than a ruse to defeat the law," and forbade the dealer to continue such practices to evade charging and advertising list prices. In other words, in the framework of the Fair Trade laws, there is a power which *when properly applied and enforced* is capable of establishing and maintaining list prices for any commodity that is Fair Traded.

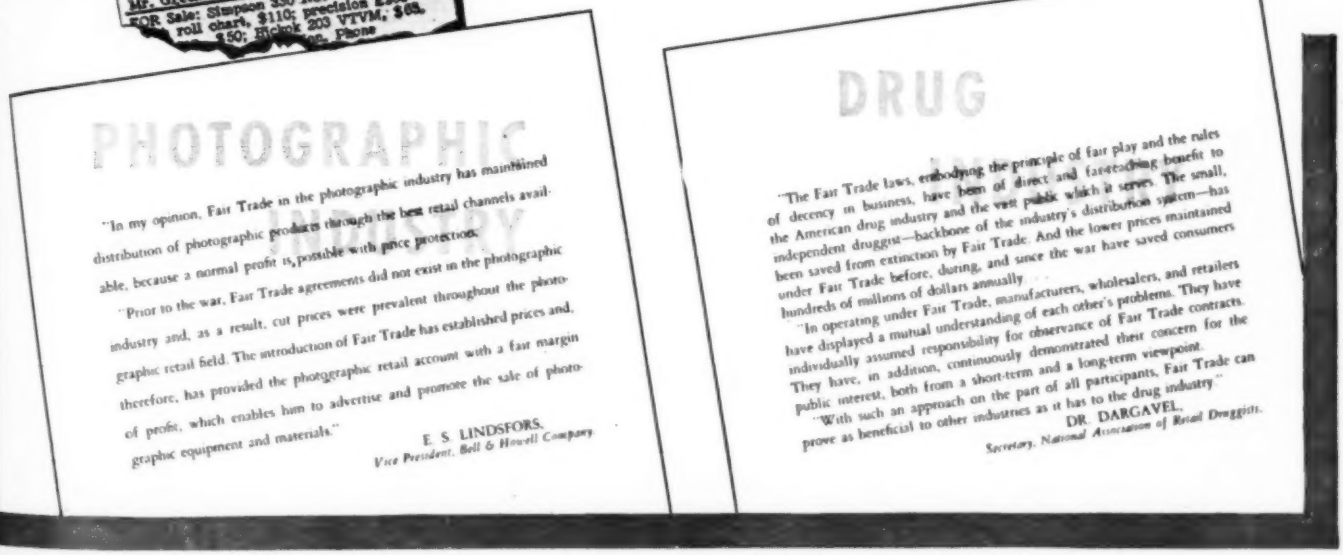
First, it should be made clear that while Fair Trade laws, when enforced, prevent uncontrolled and unwarranted price cutting, they do not prevent price adjustments at any time the manufacturer may deem it advisable. If he feels that a 20 per-cent reduction in the price had been made possible by lowered manufacturing costs or better distribution, the reduction is made. But it is made available to *all* the dealers, on the same basis.

Second, Fair Trading does *not* permit a manufacturer to hold his prices up at an excessive level, because he is permitted to Fair Trade his product only if it is "in open competition with commodities of the same general class produced by others." Naturally, the desire to sell against such competition will prevent his placing his Fair Trade prices any higher than he would nor-

(*Continued on page* 132)

Here are typical advertisements that clearly show the need for price control in the television field. If Fair Trading were applied to the television industry, such advertising would be kept to a minimum.




PHOTOGRAPHIC
INDUSTRY
"In my opinion, Fair Trade in the photographic industry has maintained distribution of photographic products through the best retail channels available, because a normal profit is possible with price protection.
"Prior to the war, Fair Trade agreements did not exist in the photographic industry and, as a result, cut prices were prevalent throughout the photographic retail field. The introduction of Fair Trade has established prices and, therefore, has provided the photographic retail account with a fair margin of profit, which enables him to advertise and promote the sale of photographic equipment and materials."
E. S. LINDSFORS,
Vice President, Bell & Howell Company
DRUG
"The Fair Trade laws, embodying the principle of fair play and the rules of decency in business, have been of direct and far-reaching benefit to the American drug industry and the vast public which it serves. The small, independent druggist—backbone of the industry's distribution system—has been saved from extinction by Fair Trade. And the lower prices maintained under Fair Trade before, during, and since the war have saved consumers hundreds of millions of dollars annually.
"In operating under Fair Trade, manufacturers, wholesalers, and retailers have displayed a mutual understanding of each other's problems. They have individually assumed responsibility for observance of Fair Trade contracts. They have, in addition, continuously demonstrated their concern for the public interest, both from a short-term and a long-term viewpoint.
"With such an approach on the part of all participants, Fair Trade can prove as beneficial to other industries as it has to the drug industry."
DR. DARGAVEL,
Secretary, National Association of Retail Druggists.

Letters from key men in industries upholding Fair Trade agreements strongly support the Act.

The BEGINNING AMATEUR

By
ROBERT HERTZBERG
W2DJJ

Complete low-power phone station, which occupies a table area of only 14 by 21 inches. Top to bottom: r.f. section, modulator, and Hallicrafters S-36A receiver.

Part 9. Phone is fun, but remember that it carries with it certain responsibilities.

AFTER you've accumulated a little experience with receivers, a basic c.w. transmitter, and a few test instruments, you can safely consider yourself out of the rank beginner class. You are now ready to tackle phone operation. "Tackle" is the right word, because phone is much more complicated than c.w. from the technical standpoint, and, in addition, it has social ramifications of quite unexpected nature. You'll know what this high-sounding phrase means when you go on phone for the first time, and then have half the neighborhood descend on you in great wrath because your signals break up Milton Berle's television show. The No. 1 problem of the ham fraternity at the present is TVI—television interference—and how to eliminate it.

A phone transmitter is simply a c.w. rig to which modulation equipment has been added. Two general types of voice modulation are in ham use: amplitude (AM) and frequency or phase modulation (FM or PM). For "talking" purposes, only a narrow band of frequencies is required, as compared with music transmission, so FM as used in amateur service is referred to as narrow-band frequency modulation, or NBFM.

A great deal of misleading information on NBFM has been published. On the basis of ham experience with the system since the end of the war, it can be said that its main advantage over conventional AM is that, under some circumstances, it causes less interference to broadcast reception. Also, the modulation accessories themselves are simpler, lighter, and cheaper than those needed for AM. However, in radio as in everything else, you don't get something for nothing; you get only what you pay for.

In terms of effectiveness, a NBFM transmitter is about as good as an AM transmitter of about one-quarter the power input. In other words, you can put your money into high radio-frequency power and low audio-frequency power for FM or low r.f. and high a.f. for AM. In the end, you come out with about the same results. This is not due to any superiority of AM over FM, but rather to the receivers commonly used by amateurs. If the receiver in use is equipped with a good discriminator or ratio detector, the output will be the same on either AM or FM, with the same input signal.

The use of FM has enabled the police and other emergency services to obtain results in cases where AM has failed miserably. If you intend to obtain the maximum benefits from FM, by all means buy or build an FM adapter for your receiver.

Actually, a transmitter for phone service must be a little better than one intended only for c.w. It would be an extremely bad practice, for instance, to add a modulator stage to the simple one-tube oscillator described in Part 5 of this series of articles. The rig would become unstable and raise havoc in nearby sound and TV receivers. The highly essential characteristic of stability is usually obtained by starting the transmitter with a low-power oscillator stage (using a crystal or a variable frequency circuit), following it with a "buffer" stage (sometimes several buffer stages), and terminating with a power amplifier or "final" stage. Reliable circuits using easily obtainable components exist by the dozen.

Even if you can afford a more powerful outfit, I strongly urge you to limit your transmitter to 50 or 75 watts if other people live within a radius of about half a mile. It's much easier to tame down a small transmitter than a big one to the point where harmonics, parasitics, and various other spurious signals cease to bother either sound or television reception. If you live out in the woods, get yourself a kilowatt transmitter and help support the local utilities company, but if you have neighbors and want to live with them in peace, stay on low power. You'll have a lot of fun just the same.

When you start to check the prices of modulation equipment for AM, you'll quickly discover that a modulator section costs just about as much as the r.f. section with which it is to work. The modulator will certainly be heavier, because, in addition to a virtually identical power supply, it contains a husky modulation trans-

former and perhaps an extra interstage transformer. These units are made of iron and copper, and they weigh plenty. In most cases, the more iron and copper in them, the better they are.

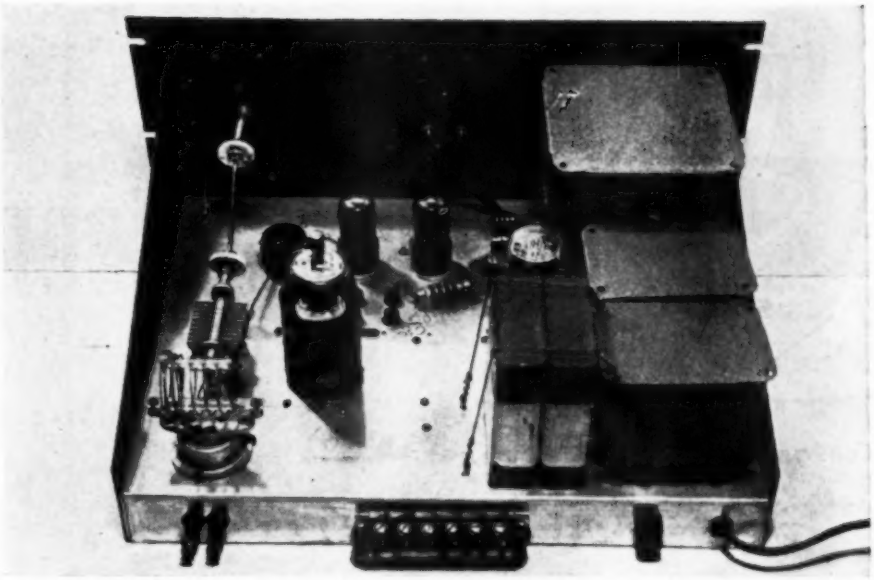
A complete AM phone transmitter of about 50 watts rating can easily add up to 150 pounds by the time it is mounted in cabinets or an upright rack. It is a very good idea to fit small plate casters to the cabinet or rack base, so that you can swing the outfit around when you want to make adjustments on it. And don't expect a fragile table to stand up under a load of this kind. You need something substantial, or no table at all. Many hams set their transmitters right on the floor, and use the table space for the receiver, operating controls, mike, etc.

NBFM equipment is very simple, consisting of only a few resistors, condensers, chokes, etc., which can usually be installed on the r.f. chassis without crowding.

Since voice transmission starts with a microphone, regardless of the type of modulation, the power, or the operating frequency, it pays to invest in a good one. Of the several types in general use (carbon, crystal, velocity, and dynamic), the crystal is most generally favored by hams because it is simple, reliable, and has good frequency response. Carbon mikes, available for less than a dollar as surplus, are entirely satisfactory for some purposes, but they require from three to six volts of battery supply, which is something of a nuisance. The velocity and dynamic types, which work on a magnetic principle, require special coupling transformers and run a bit on the expensive side.

For checking the adjustment of a phone transmitter, there is nothing to equal a cathode-ray oscilloscope. That's why I recommended this instrument so strongly in Part 8 of this series. TVI complaints in television areas would be far fewer if more hams spent less on power supplies for their transmitters and put the difference into 'scopes. It is disgusting to hear queries like this on the air, "Say, old man, can you give me a quick idea as to how I sound? I can't tell just where to set the gain control on my speech amplifier." If a ham doesn't know how his modulator is performing he should stay off until he finds out. Many an otherwise careful operator who checks his frequency to two decimal points sets his modulator gain knob to an arbitrary position and then hopes for the best.

Holders of Class "B" licenses almost invariably use the 10-meter band for their initial phone attempts. The higher bands are also open to them, but they are much trickier. Ten is a good place to start because power on this band is much less important than a proper antenna. Since a half-wave wire is only about sixteen feet long, it can be accommodated quite comfortably on a small roof or inside the attic. I know of some apartment dwellers who have folded-dipole ribbons tacked to the picture molding of their living rooms and work all over the world with 'em. For consistent results, however, a "beam" is the thing. Three-element affairs are the most common, because they are just about right from the mechanical standpoint. More complicated structures are too heavy for many roofs and are too readily blown down.



The complete r.f. deck of a small but ruggedly-built ham transmitter. The power transformer, filter chokes, and filter condensers are along the right end of the 13 by 17-inch chassis. Tube lineup: 6V6 crystal oscillator, 6V6 doubler-buffer, 807 final. Input to final, about 30 watts. Plug-in crystals and coils give range from 10 to 80-meter bands. By itself, this is a self-contained c.w. transmitter.

The answers to any technical problems of voice operation can be found in any of the standard ham manuals. The answers to some of the problems of personal behavior can't be found in any books. Before you go on the air for the first time with a phone transmitter, *please* try to remember that anything you say into your mike is likely to be heard by many people who are not hams and do not know what the ham game is all about. For three decades, ham radio has been defending itself in the ears—and now the eyes—of the public, against the charge that amateurs are irresponsible dopes, who clutter up the air with inane, stupid, trivial, and inconsequential chatter. Anyone who listens on the phone bands must admit, however reluctantly, that there is some *small* element of truth in the

(*Continued on page* 146)

The matching modulator unit that turns the r.f. section (pictured above) into a phone transmitter. Note that the power supply, along the right end, is practically the same as before. Additional interstage and modulation transformers, along left edge, make this unit difficult to lift. The relays in the center permit push-to-talk operation from the mike stand. Tube lineup: 6J7 mike amplifier, 6J5 amplifier, push-pull 6L6's. This modulator unit costs more to build than the r.f. section.

FRINGE AREA *Television* RECEPTION

By R. W. SANDERS
Advanced Development Section
Farnsworth Div., I.T.&T.

Proper antenna and booster design are essential for longe-range TV reception.

ALTHOUGH of relatively small value commercially, DX television is of considerable interest to most engineers. Actually, DX television reception is at the present time a liability to the television industry. This is evidenced by the fact that the FCC has frozen all pending TV station applications. The present allocation plan was set up on the basis of a signal strength of 5000 microvolts per meter for the primary service area, and 500 microvolts per meter for the secondary service area. Some of the better commercial receivers, with the aid of a well-designed booster amplifier and special antenna system, can receive excellent television pictures when operating in areas where the field strength is less than 50 microvolts per meter.

This discussion is based on areas where the average signal strength is on the order of only 5 microvolts per meter, areas which might be called the "fringe-fringe."

Ft. Wayne is situated in the heart of one of these. The city has two companies, *Farnsworth* and *Magnavox*, currently producing television receivers. *Farnsworth*, although it had one of the first television stations in the country, is still operating only on an experimental basis. Therefore, the television station nearest Ft. Wayne is WSPD-TV in Toledo, which is approximately 90 miles by air from Ft. Wayne. Within a radius of 185 miles, there are twelve television stations in operation. These stations are channeled as follows:

One on Channel 2, one on Channel 3, four on Channel 4, two on Channel 5, two on Channel 7, one on Channel 9, and one on Channel 13.

Factors of great importance in operating a television receiver in a "fringe-fringe" area are as follows:

(1) signal-to-noise ratio;
(2) sync stability;
(3) sound system;
(4) resolution; and
(5) interference.

Elements involved in obtaining the best performance are the antenna system, the booster or pre-amp, and the circuits in receivers.

The antenna must have as high gain as practical and, in areas such as Ft. Wayne which has several stations that can be received on the same channel, must have a good front-to-back ratio. The antenna gain and the transformer gain preceding the first tube are the only gains which give a direct improvement in signal-to-noise ratio.

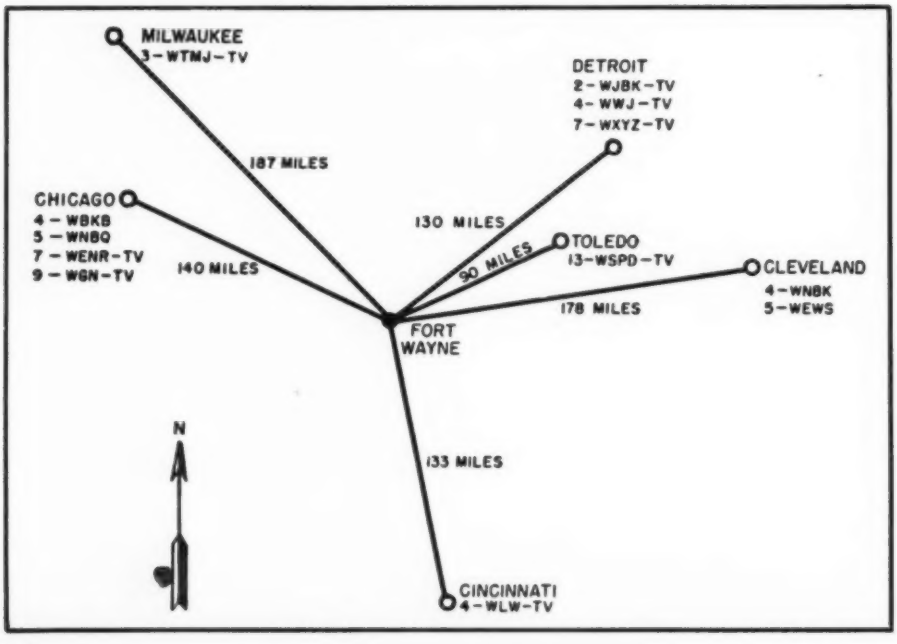
Commercial antennas on the market, even though they may have parasitic elements and may be stacked affairs, are generally unsatisfactory for DX television. Antennas using parasitic elements are very critical, and in order to realize the maximum gain they must be cut not only to the particular channel desired, but also for the specific frequency.

For example, an antenna which was used in Ft. Wayne, consisting of a folded dipole, one reflector, and two directors, was cut for Channel 4 video carrier frequency. However, the gain at the sound frequency was less than that of a simple folded dipole. A similar antenna cut for 71.75 megacycles will give excellent sound; however, the gain at the video carrier frequency is about the same as for a simple folded dipole.

A relatively simple antenna which was developed and is being used quite extensively in Ft. Wayne consists of a folded dipole with the reflector cut for the video carrier frequency and the director cut for the sound frequency. This antenna has a gain of 5 db. over a folded dipole at the video carrier frequency and a gain of 6.5 db. at the sound carrier frequency. The video front-back ratio is 19 db., and the sound front-back is 12.5 db.

To examine the antenna problem in more detail, refer to Fig. 2. This shows the relative gain characteristics of a Channel 4, 3-element antenna and a Channel 5, 3-element antenna. Consider first the Channel 5 antenna. In order to make the measurements, a dipole was set up 30 feet above the ground. This antenna was fed by a Ferris generator, and the generator ouput was held constant. The receiv-

Fig. 1. The principal TV transmitters in the neighborhood of Fort Wayne, together with their direction, distance, and channel number.



ing antenna under test was also 30 feet high and located approximately 100 feet from the transmitting antenna. A folded dipole, cut to the frequency of the antenna under test, was first used as a basis of comparison for the multi-element antenna. A 300-ohm transmission line was used to feed from the antenna under test to a field-strength meter which properly terminated the line. Relative gain of the dipole at the various frequencies shown was taken. The gain of the dipole as a reference point was considered as 0 db. over the range of frequencies shown in Fig. 2.

The Channel 5 antenna was calculated for the video-carrier frequency of 77.25 mc. Fig. 2 shows 2 curves for this antenna. One curve (front) is for instances where the antenna is pointed directly toward the transmitting antenna. The second is with the antenna position rotated 180° (back). Referring again to Fig. 2, we can see that the antenna at the video-carrier frequency of Channel 5 will give a gain of 7.2 db. over the folded dipole cut to this frequency. We can also see that with the antenna in the reverse position the antenna gain is 18.4 db. below that of the folded dipole. In other words, the front-to-back ratio of the antenna is 25.6 db. In examining the same antenna at the sound carrier frequency, we find a gain of 6 db. over the folded dipole. The sound front-to-back ratio is, therefore, only 7 db.

It will also be noted that for all frequencies below 71.5 mc., the gain of this array in the forward position is less than that of a dipole tuned to 77.25 mc. It can be noted that in the backward position, the only frequencies at which the gain of the antenna is equivalent to that of a 77.25 mc. dipole is between 63 mc. and 72 mc.

As to the operation of this antenna on Channel 5, consider the following: The amount of tolerable interference at the sound frequency is greater than would be allowed at the picture carrier frequency. In other words, where 7 db. would not be acceptable at the video carrier frequency, in the case where we have 24 db. video front-to-back ratio, it would probably be sufficient to insure against garbled sound. In a noise-free television picture, 40 db. attenuation between the desired and interfering signal levels is sufficient to insure against objectionable interference. In the fringe area where noise is usually present to the extent that it degrades the definition of the picture, 24 db. down is just about the tolerable limit of the interfering signal. This assumes the interference to be the beat between video carriers, and this is the worst example. Therefore, this antenna would be able to choose between two stations in opposite directions, provided they were of equal signal strength. Should the signal strength of one be greater than the other, the one with the greater strength would give the only satisfactory picture.

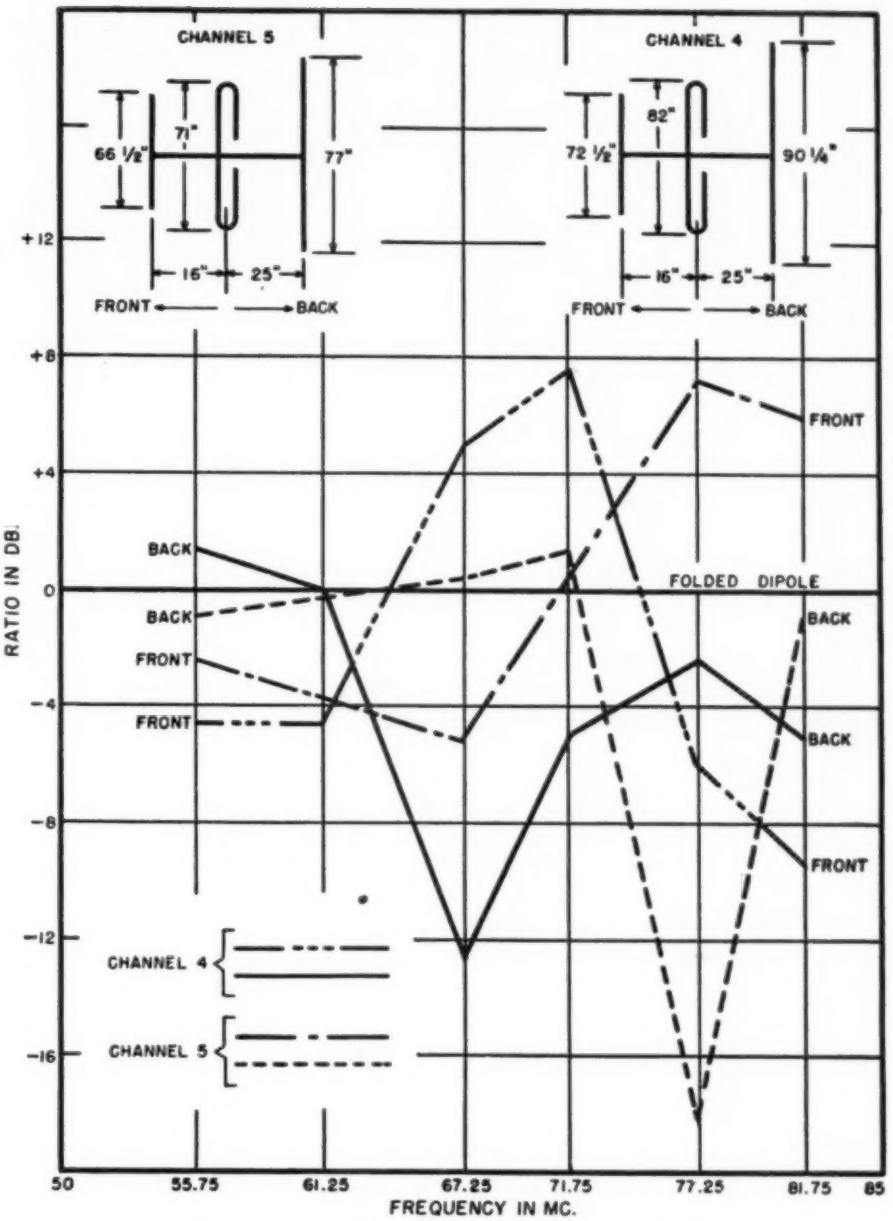


Fig. 2. Dimensions of a folded dipole with director and reflector for both Channels 4 and 5. The graphs show the gain in both the forward and backward direction for these two antennas for Channels 2 through 5.

As previously mentioned, there are twelve television stations within a radius of 185 miles of Ft. Wayne. They are located in all directions from Ft. Wayne as shown by Fig. 1. Since several lay down equally good signals in that city, it would be necessary to have quite a large number of individual antennas unless a rotating antenna or group of antennas were available.

The importance of the remotely controlled antenna was realized immediately following the war. A rotating antenna was designed at *Farnsworth* during 1945. The antenna housing contained a 1/100 H.P. 24 v. a.c. motor and a 40 to 1 gear reduction chain. Mounted above the motor was a limiting switch which kept the amount of rotation down to 365°.

This antenna was then put in production by another firm, but only small quantities were made in each production run. Consequently, the price of the antenna was high.

The *Alliance Manufacturing Company* has also realized the importance of the rotating type television antenna, and is entering this field on a large scale, producing a rotating mechanism which embodies most of the features of the above antenna head and several additional ones.

One of the most important factors is that they have provided for production of this device on a large scale and, consequently, the price per unit is quite reasonable. Another advantage of this mechanism is the increased torque available. The *Alliance* unit is so constructed that, although it is designed to support an antenna weighing up to 20 pounds, heavier antennas can be rotated with the addition of a small auxiliary bearing. This bearing clamps to the antenna mast and removes much of the strain from

the motor bearings. A pilot bulb on the control box shows when the antenna has reached the end of the 365° excursion.

The Booster

In operating a receiver in the fringe area, a properly designed booster, or pre-amp, is a necessity. This has two important functions. The first is to increase over-all gain of the receiver. The second is to obtain as good signal-to-noise ratio as possible. The noise referred to here is thermal-input noise, and not man-made interference.

Television receivers have noise limiting circuits in the sync-amplifier chain. Most receiver sync-circuits are so designed as to start limiting at a minimum signal of between 50 and 500 microvolts input to the receiver antenna terminals. In the fringe area the signal is quite often less than this. Therefore, it is necessary that the pre-amp have sufficient gain to cause proper noise limiting of the sync pulses on signals of such low input that the thermal noise on the picture screen will render the picture unusable.

The problem of sufficient video gain to permit proper picture contrast is the same as the sync problem. However, if the pre-amp has sufficient gain to permit saturation of the sync circuits, it will be ample to provide sufficient video at the picture tube grid.

The second problem is to provide a good signal-to-noise ratio. In a good television receiver, nearly all the noise is generated in the first tube.

We have two sources of noise in the input circuit of a pre-amp. The first is that generated in the terminating resistor of the transmission line. This noise is fixed and is usually the noise generated in a 300 ohm resistor when the standard 300 ohm line is used. The second is the thermal noise developed by the tube itself. The amount of this noise varies, depending on the tube used. It is obvious that we wish to keep this noise as low as possible.

The noise out of the pre-amp for the untuned input will be the total input noise times the tube gain, and in the case of the tuned input will be the input noise for the tuned input, times the transformer gain times the tube gain.

Table I shows a comparison of various tubes used in pre-amps. There are several interesting facts set forth in this table. Referring to Columns C and D, a good triode will have less noise with an untuned input than will the pentodes with the tuned input. It is also of interest that a tuned input helps the signal-to-noise ratio very little for triode amplifiers, while a considerable advantage is realized by using a tuned input circuit ahead of the pentode amplifiers. Column E shows that the triode pre-amps also give greater gain than the pentodes.

In the choice of a pre-amp, it is possible to select one where the signal-to-noise ratio will be worse than if no pre-amp were used at all. For example, if a pre-amp were chosen which utilized a 6AK5 ahead of a receiver using a 6J6 r.f. amplifier, it would take 23 microvolts signal at the antenna terminals to produce unity signal-to-noise. However, without the pre-amp it would take only 8 microvolts to produce unity signal-to-noise.

This does not mean that it is impossible to use this type in conjunction with the receiver and get improved performance. If the signal were too weak to hold sync or allow sufficient contrast with maximum contrast setting of the receiver, the added gain of the pre-amp might allow sufficient contrast in the picture and sufficient sync stability to obtain a recognizable picture even though the noise was very bad.

Another interesting example might be the case where a 6J4 with an untuned input is used to feed a receiver which uses a 6AU6 r.f. amplifier with an untuned input. Under these conditions, according to Column C, only 6 microvolts should be required for unity signal-to-noise. However, an examination of Column F reveals that the noise out of the pre-amp would be 34 microvolts, which is very close to the input noise of the 6AU6, or 29 microvolts. Adding these two figures in quadrature gives 45 microvolts.

Referring this back to the input we find that for unity signal-to-noise we require not 6 microvolts but 45/5.7, or 7.9 microvolts. This merely shows that for this particular case all the noise is not being generated in the input of the pre-amp. If a tuned input were used ahead of the 6J4, the added gain would be sufficient to override the noise generated in the first tube of the receiver. Such a pre-amp, however, is difficult to build, in that neutralization is required to prevent oscillation.

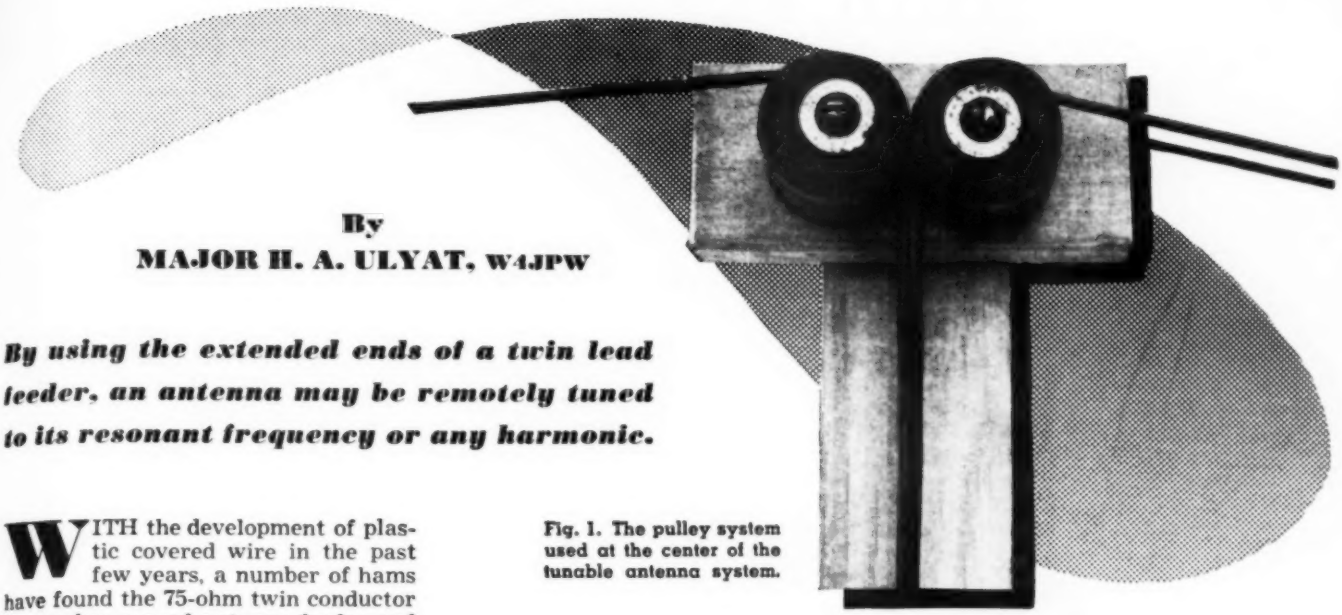
Circuits

Insofar as the circuits in the television receiver are concerned, there is not too much that can be done; however, a few pointers might be of in-

(*Continued on page* 148)

Table 1. A comparison between various tubes used in preamplifiers.

Tube	A R_{eq} $R_{eq} = 3/G_m$ (Triode) $R_{eq} = \frac{I_p}{I_p + I_{c2}}\left(\frac{2.5}{G_m} + \frac{20 I_{c2}}{G_m}\right)$ (Pentode)	B Tube Noise $E = \sqrt{4KTR\ \Delta f}$ ($K = 1.37 \times 10^{-23}$ Joule/°K) ($T = 300$°K) $\Delta f = 4$ mc.	C Input Noise Untuned Input $E_1 = \sqrt{E_{nt}^2 + E_{nr}^2}$	D Input Noise Tuned Input $E_t = \sqrt{\frac{3E_{nr}^2 + E_{nt}^2}{3}}$	E Tube Gain Plus Match Loss (Z)	F Noise out of Pre-Amp for Untuned Input ($C \times E$)	G Noise out of Pre-Amp for Tuned Input ($3D \times E$)
6J4	250 ~	4.05 μv.	6.0 μv.	4.63 μv.	$\frac{17.6}{3} = 5.7$	34.2 μv.	81.5 μv.
6J6	565 ~	6.1 μv.	7.54 μv.	4.87 μv.	$\frac{10.5}{3} = 3.5$	26.4 μv.	51.2 μv.
6AG5	6610 ~	20.8 μv.	21.2 μv.	8.23 μv.	$\frac{13.5}{3} = 4.5$	95.5 μv.	111 μv.
6AK5	7530 ~	22.3 μv.	22.8 μv.	8.66 μv.	$\frac{13.8}{3} = 4.6$	105 μv.	120 μv.
6AU6	12,200 ~	28.5 μv.	28.9 μv.	10.5 μv.	$\frac{14}{3} = 4.7$	136 μv.	147 μv.
Transmission Line	300 ~	4.43 μv.					



By
MAJOR H. A. ULYAT, W4JPW

By using the extended ends of a twin lead feeder, an antenna may be remotely tuned to its resonant frequency or any harmonic.

Fig. 1. The pulley system used at the center of the tunable antenna system.

TUNE YOUR ANTENNA With a String

WITH the development of plastic covered wire in the past few years, a number of hams have found the 75-ohm twin conductor line makes a good antenna feeder and that it is plenty strong enough for the antenna itself. It has been found waterproof, weatherproof, and tough enough to stand up over long periods of use. Once started, it will separate easily when the ends are pulled apart. This wire should not be confused with certain rubber-covered varieties which have high losses when exposed to wet weather.

The ideal set-up, therefore, would be to use one solid piece of this wire for the whole antenna system, with no joints to solder and tape and no uninsulated wires to get wet. Even the ends may be treated with waterproofing dope.

If, in addition to this, the actual length of the antenna can be changed to secure maximum loading for any operating frequency within any one particular band, as well as the bands that lie within the odd harmonic of the fundamental, it stands to reason that we will need no antenna tuning unit. The feeders can be connected directly to the link in the final tank. The result is a minimum amount of loss and a maximum amount of radiation. Loading can then be regulated by adjusting the link in the final tank circuit.

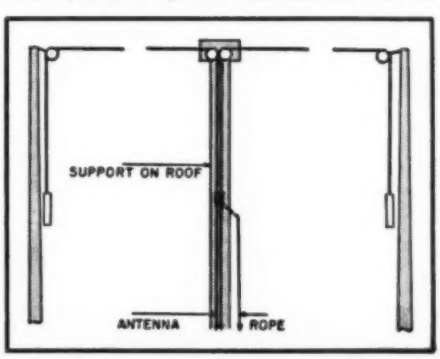
The secret of this accomplishment lies in the mechanical set-up of the antenna itself. The system to be described avoids all cutting and splicing and all the other headaches connected with pruning and splicing a doublet six inches at a time, trying to find the right length to make it load properly. No test instruments are required, other than the plate current meter on the transmitter itself. Once the system is erected, you can tell your helpers to go on home; you are able to sit by your transmitter in the shack and make your antenna adjustments on the nose from your "easy chair."

The following instructions give dimensions for a 75- to 80-meter doublet which will load satisfactorily on 20 meters. A similar 40-meter doublet, which would serve for 10-meters, could be made by reducing the antenna length by one-half.

A suitable mast or tree at each end will be needed to support the antenna. These should be at least 140 feet apart. Midway between them, we shall have to erect another pole to support the center, which need not, however, be as strong as the end supports, as its job is mainly to support the center. There will not be much side pull on this mast if the weights on the ends are the same, and the pulleys turn easily.

On the center mast, securely fasten two paraffin-soaked, hardwood pulleys as shown in the illustration. If pulleys made of better insulating material can be found of the right size, so much the better, but wooden spools can easily be turned on a lathe and grooved to the right depth. The groove should taper slightly.

Fig. 2. The antenna supporting system. Counterweights take up slack in the antenna ends.



When properly set up, these pulleys should touch each other and roll freely. It should be possible for the wire to work back and forth in them without jamming, and yet the separated wire sections should not have any appreciable space between them beneath the pulley. It might be advisable to have several similar sets of pulleys along the split section of the feeder to keep the two wires of the feeder close together at all points. A small piece of wire can be used to make the experiment before raising the mast. This precaution is very necessary.

The length of the line to begin with will be about 70 feet, plus the distance from the pulleys on the center mast to the transmitter. If in doubt, use a little extra so no splicing will be needed. The wire is fed from the bottom, up through the opening made by the grooves in the pulleys on the center mast. It is then separated and pulled apart, with enough coming through so that the ends can be reached when the pole is erected. The center mast is then set up, using whatever guy wires or supports necessary.

Now, fasten the ends of the antenna to strong, paraffin-soaked cords and run them through pulleys secured to the tops of the end masts. These cords are pulled at the same time until the antenna stretches out to about 110 feet in length. Do not pull more than this for the present.

When the ends are pulled, the feeder will come up through the pul-

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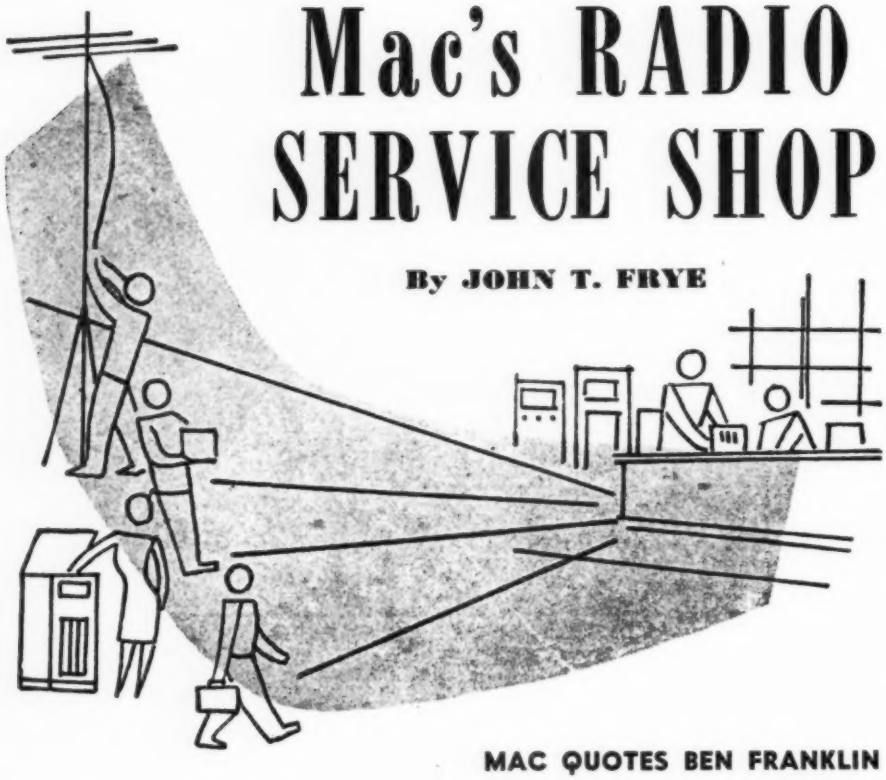
Mac's RADIO SERVICE SHOP

By JOHN T. FRYE



MAC QUOTES BEN FRANKLIN

NOW and then the lazy breeze that put just the final touch of perfection to the beautiful October Indian Summer afternoon wafted a slight odor of burning leaves into Mac's Radio Service Shop where the owner and his assistant, Barney, were busily at work at the bench. Suddenly the red-headed youth dropped his alignment screwdriver and pointed an accusing finger at the chassis on which Mac was working.

"Oh, oh!" he said triumphantly. "I saw that! Here you have been lecturing me on making neat solder joints, and just look at what you are doing: You cut the lugs loose from that twist-prong electrolytic without unsoldering the wires, and now you are soldering them right onto the lugs of the new condenser. Do you call that a neat-looking solder job?"

"A foolish consistency is the hobgoblin of little minds," Mac resignedly quoted to himself as he turned the a.c.-d.c. chassis upside down and shook it vigorously to make sure no loose particles of solder remained inside to cause trouble.

"Well, Junior," he said as he put the set aside, "I must admit that I am not practicing what I preached. I *did* tell you that you should make each solder job look as nearly like the factory solder joints as possible, and I must confess that those connections I just made are not things of beauty.

"However, there are some extenuating circumstances. In the first place, look at how cramped for room this chassis is. Parts are crowded and jammed into every square inch of space so that there just is no room left for maneuvering a soldering iron and the needle-nose pliers. Note, too, that the condenser lugs are used as tie-points for much of the wiring of the set. Each lug has several wires going to it, including two or three paper condenser leads.

"Now if I took the time to remove each wire, I should have to spend many more minutes on this job; furthermore, unless the lugs could be made absolutely free of solder and perfectly straight, it is most likely that I should have broken the bakelite mounting socket in trying to remove the old condenser. On top of that, in wrestling around the leads of the paper condensers, I would be almost certain to break one loose from its foil; or one of the wires would break off too short and have to be replaced.

"When I told you to make a 'good-looking' solder joint, my main concern was to see that you made a 'good' joint. I knew that if the solder flowed smoothly around the wires, and if there was no excess of solder or rosin to mask the actual connection, the chances would be excellent that the joint was electrically all right. See what I mean?"

"Yes; it is the same thing our biology teacher used to tell us. Nature causes men to go for pretty girls and girls to like handsome men because beauty and health usually go together. The beauty is not important in itself but for what accompanies it. Did you ever notice how healthy I am?" Barney asked as he thumped himself vigorously on the chest and then subsided into a fit of coughing.

"A fine physical specimen," Mac agreed dryly; "but to return to the subject, did you notice that I took care to loop one wire of each tie-point through both old and new lugs so as to make each joint mechanically solid before flowing the solder? I made sure that every one of those joints was solid as a rock, even though they do have their aesthetic shortcomings.

"The whole point is that the customer gets just as good a job with this method for less money than he would if I removed and replaced each wire separately. In addition to the extra time for which I should have had to charge him, he would quite likely have had to pay for one or two paper condensers ruined by tugging and twisting its leads; moreover, I have learned from long experience that the less the wiring and parts of a set are disturbed the smaller is the likelihood that it will develop new troubles. Especially is this true in the case of an older set, like this one."

"Yes, but I thought you wanted to make money. If you spend more time on a set and put in more parts, you make more money, don't you?"

"You make more on one set, but you lose out in the long run," Mac replied. "Do you remember what old Ben said?"

"Ben who?"

"Benjamin Franklin, who might be called the daddy of radio since he used a kite string for an antenna and his knuckle for a receiver in proving that lightning was electricity. He had as much horse-sense as any American in history, and he said, 'Honesty is the best policy.' Mull that over a bit. He was not advising that you be honest because it was the moral thing to do or because religion taught that you should. He simply meant that consistent, unvarying honesty is good business; and it is."

"You mean that when you are working on a set you ought always to be thinking of the customer's interests?"

"Exactly. You should always be trying to put the set into the best possible condition in the least possible time."

"Even when you are charging by the hour? How are you going to make any money that way?"

"By turning out more sets in a day. Suppose, for example, you have a shop and turn out ten sets a day, while I turn out fifteen. Both of us charge the same hourly rate; so it might seem that I am getting the worst of it, inasmuch as I am doing more work for the same money you get; but just remember that the cost to my customers would be, on the average, only two-thirds as much as you charge them. Assuming that we do equally good work, which one of us do you think will be getting the most of the business?"

"Yeah, but how about it when times are tough and there aren't so many sets to service. Won't your cut-rate business backfire then?"

"There is nothing cut-rate about it. Remember we charge the same hourly rate. Individual charges are brought down by increased efficiency, just as they are in our mass-production fac-

(*Continued on page* 168)

A SIGNAL TRACER At Minimum Cost

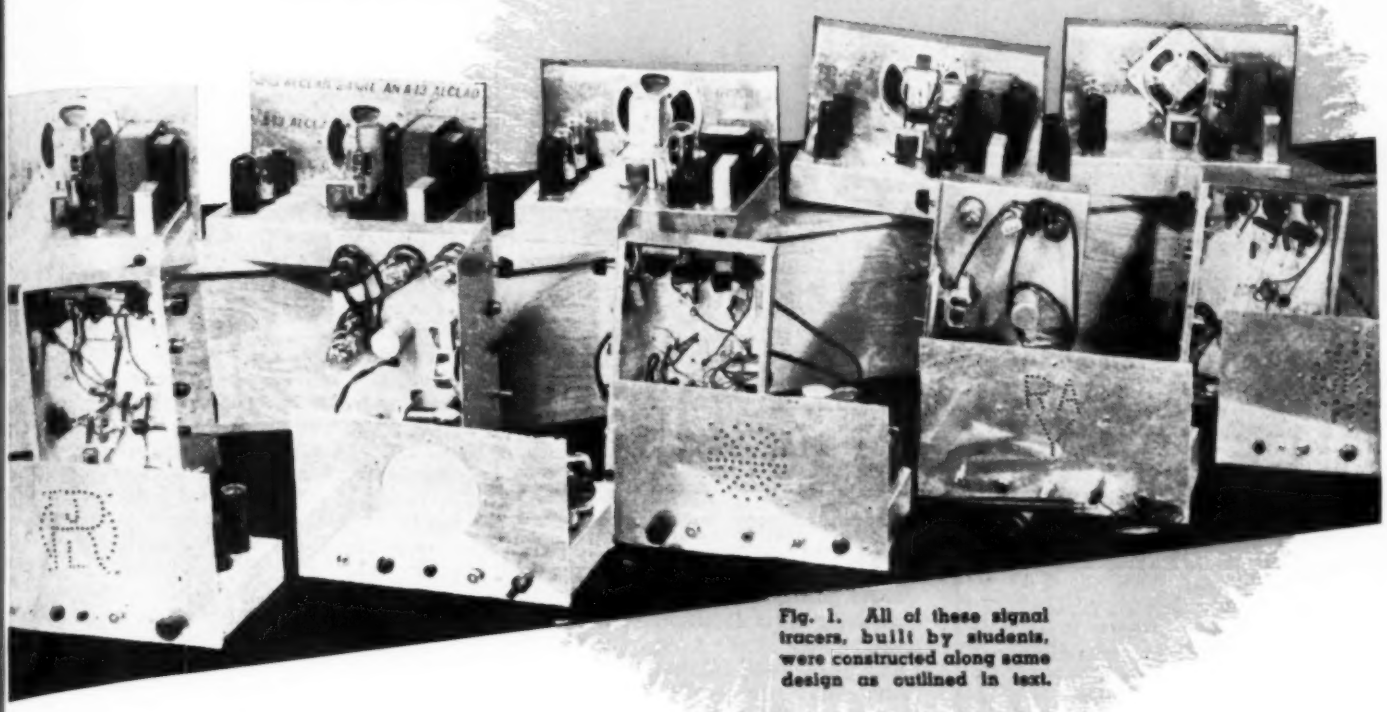


Fig. 1. All of these signal tracers, built by students, were constructed along same design as outlined in text.

By DONALD G. WARD*

Complete details for an easy-to-build unit that can be used for r.f., i.f., and audio signal tracing.

WHEN our broadcast receiver service course was inaugurated about 18 months ago, it was decided that the only thing to do was to start right in with the use of the signal tracing methods of receiver testing. This method, of course, is gradually being adopted by the most up-to-date radio service technicians, owing to the amount of time it saves in analyzing receiver troubles.

Having decided upon the course of training to be employed, the next step was to secure the necessary equipment. The most sensitive tracers are, of course, the tuned input tracers. Two difficulties with these tracers are, first, the necessity of tuning to the approximate frequency of the signal and, second, the cost of such tracers.

On the other hand, the sensitivity of the untuned tracers was not sufficient for our purpose. We then went ahead and set up our own standards as to what we wanted in a signal tracer and followed through on the final design.

The standards that were set up are as follows:

1. It must be able to pick up signals from an ordinary receiving antenna.

2. It must respond to radio frequency, intermediate frequency, and audio frequency signals without any switching, tuning, or changing of probes.

3. It should be so easy to build that it may be constructed by a student in the radio course when he has completed only two weeks of theoretical instruction.

4. It must be built at an absolute minimum of cost.

The reasons for setting up these standards were as follows:

1. The specified sensitivity was dictated by the normal requirements of a high-quality signal tracer.

2. The unit must not have any tuning controls, as they would be very confusing to a man without much theoretical training. The reason for this was, of course, that it was necessary to have a tracer that a man could use all through his course of instruction.

The final two requirements were dictated by the belief that the instrument would perhaps be wanted by the students after they had completed their courses of instruction.

Approximately ten different models of signal tracers were constructed by various members of our instruction staff before a final design was established. Since then, about 250 of these instruments have been built by various students with invariably fine results.

Tracer Circuit

As will be noted from the schematic diagram (Fig. 2), the circuit is that of a high-gain, three-stage, resistance coupled, audio frequency amplifier having a loudspeaker in the output of the power amplifier stage.

As a matter of fact, frequency response curves taken on several of these amplifiers have indicated that they are remarkably flat from 60 to 15,000 cycles. Of course, the speaker that we use in this tracer will not respond to such frequency characteristics.

This tracer was not designed with any view of producing a high-quality audio frequency amplifier. Sensitivity was the only feature in mind when this instrument was developed.

One of the principal advantages one gains over and above the saving of money in constructing this instrument is that once you have built such

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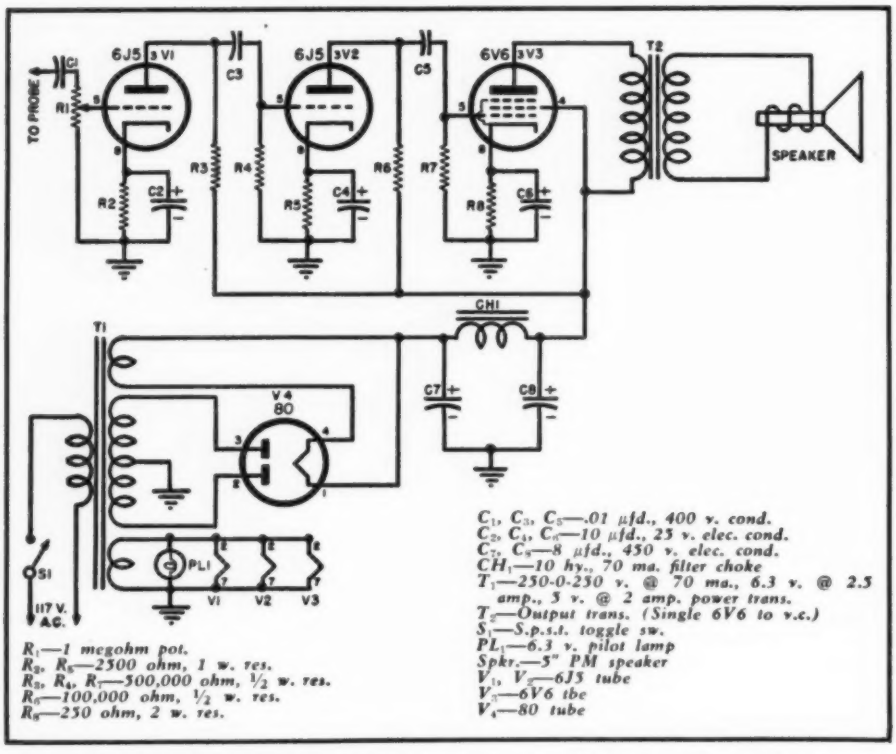


R_1—1 megohm pot.
R_2, R_5—2300 ohm, 1 w. res.
R_3, R_4, R_7—500,000 ohm, ½ w. res.
R_6—100,000 ohm, ½ w. res.
R_8—250 ohm, 2 w. res.

C_1, C_3, C_5—.01 μfd., 400 v. cond.
C_2, C_4, C_6—10 μfd., 25 v. elec. cond.
C_7, C_8—8 μfd., 450 v. elec. cond.
CH_1—10 hy., 70 ma. filter choke
T_1—250-0-250 v. @ 70 ma., 6.3 v. @ 2.5 amp., 5 v. @ 2 amp. power trans.
T_2—Output trans. (Single 6V6 to v.c.)
S_1—S.p.s.t. toggle sw.
PL_1—6.3 v. pilot lamp
Spkr.—5" PM speaker
V_1, V_2—6J5 tube
V_3—6V6 tbe
V_4—80 tube

Fig. 2. Basically the signal tracer is a conventional 3-stage audio amplifier.

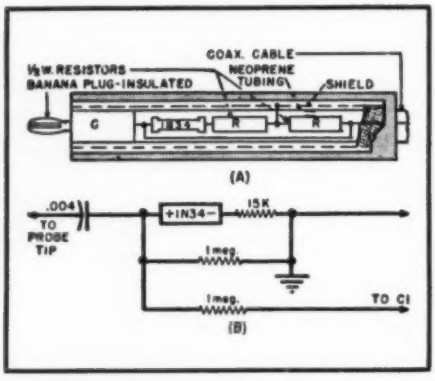


Fig. 3. Diagram of special test prod.

an instrument, it can be repaired, should it fail at any time.

A sufficiently large number of these instruments has been constructed, tested, and used so that the constructional difficulties are known completely. The instruments have been used over a long enough period that the exact results to be obtained with these tracers are fully known.

The photograph (Fig. 6) shows the panel layout. The speaker is behind the panel, the sound coming through the pattern of holes in the panel. Across the bottom of the panel, reading from left to right, are the pilot light, "On-Off" switch, volume control, tracer probe connection, and ground-lead connection.

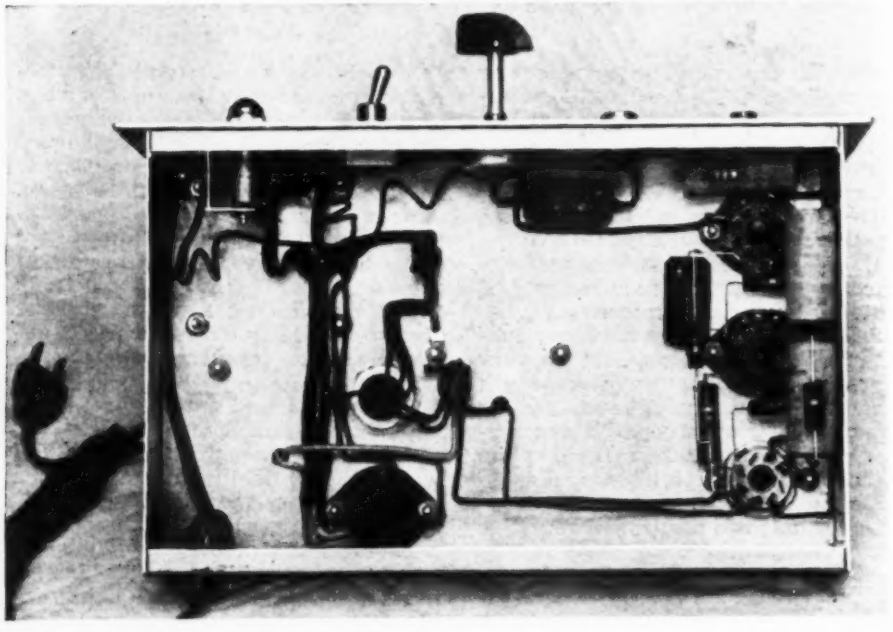
The photograph in Fig. 5 shows the completed chassis with all parts and tubes in place. The photograph in Fig. 4 shows the chassis as viewed from below, with the locations of the remainder of the parts in position and the complete wiring layout.

It is to be highly recommended that the details of this layout be followed very closely as the unit is the result of a long series of tests and has been proven to give the best results.

As will be noted from Fig. 4, a greater part of the wiring is laid in with rigid connections, and the wire is run in straight lines. This was done in order to avoid capacities between wiring which would tend to cause the amplifier to oscillate or squeal. This type of wiring is to be recommended, though it is not absolutely necessary, as signal tracers using this circuit have been constructed in the conventional manner, without any difficulty. That is, the wires have been run directly across the shortest distance between any two points.

Naturally, the more attention that is paid to details in constructing this instrument, the greater will be the improvement in operation. All joints should be mechanically strong before being soldered. The better grade of rosin core solder should be employed throughout. No soldering flux of any kind except that in the core of the solder should be used. The soldering iron should be hot enough so that the solder will flow rapidly and burn out the rosin completely. A minimum amount of solder should be used on each joint.

Fig. 4. Under-chassis view of completed test unit. Note neatness of wiring.



Probe Construction

The sketch in Fig. 3 gives the details of the construction of our detector probe. Owing to the fact that this circuit is that of a fairly high-gain audio frequency amplifier, a considerable amount of care must be used in shielding the probe and cable used with this tracer. The shielding *must* cover the crystal and resistors in the probe right up to the tracer probe point. The probe point is a banana jack, which is used so that a solid contact may be made to the various test points on the receiver. The 1N34 crystal is connected with the positive end of the crystal connected to the test point. A 15,000 ohm, 1 watt resistor is connected in series with the crystal, so that if the probe touches a point carrying plate potential in the receiver under test, not enough current will be passed through the crystal to burn it out.

The lead from the test probe connector to the volume control (through C_1) and from the center tap, that is, the variable arm of the volume control, to the grid of the first audio frequency amplifier is also shielded with braided shielding.

The probe lead is made of copalene cable, the smaller size, which is shielded. First the crystal, condenser,

and the resistors are connected together and to the probe banana plug. Then a piece of neoprene tubing is slipped over the complete assembly and the insulated end of the banana plug. A piece of braiding is then pulled over the neoprene tubing and is made long enough so that the braid comes about ⅛" below the metal part of the banana plug, and the lower end is soldered to the shielding of the copalene cable. A piece of insulating tubing is then slid over the copalene cable. A piece of insulating tubing is then slid over the neoprene tubing of such a diameter as to fit snugly over the banana plug and neoprene tubing.

Both the neoprene tubing and the outer covering were secured from war surplus stores and are obtainable in most localities.

Testing

Let us now assume that your signal tracer has been constructed, all parts mounted, and the wiring completed. Let me suggest right here that you once again recheck every wire to see that it goes to exactly the right connections and to no other, and that all of the points are connected as called for in the schematic wiring diagram. With this recheck completed, we are ready to proceed with our testing of the complete unit.

As a first step let us check the filaments of our amplifying tubes. Remove the rectifier tube from the socket in order that your amplifier tubes will have no plate voltage, and with the two 6J5's and the 6V6 tubes in position, plug the tracer power lead into a 120 volt, 60 cycle, a.c. circuit, and turn on the tracer at the "On-Off" switch.

See that these three tubes light up properly. Assuming that they do, turn off the tracer and remove these tubes from their sockets, putting the rectifier into its socket. Turn on the tracer and see that the rectifier filament lights up properly and that the plates of the rectifier do not turn red.

If the plates of the rectifier glow red, turn the tracer off immediately, as this is an indication of a short circuit on the rectifier output. Seek out this short circuit and clear up the trouble.

If, on the other hand, the tube plates of the rectifier do not overheat, shut off the tracer and put the three amplifier tubes back into the tracer. Turn on the tracer and adjust the tracer volume control to maximum gain. Touch the tracer probe with one finger; if it is operating properly, the loudspeaker should give off a very loud 60 cycle hum.

Our next test is to try our tracer on an actual signal. To do this, simply touch the probe to any receiving aerial, and connect the ground clip of the tracer to a ground connection. Turn on the tracer and set the volume control of the tracer at about center position. Provided the tracer is in proper condition, all of the signals from the local broadcasting stations will be heard, with a volume commensurate with their power and their distance from the signal tracer. Naturally it will be a jumble of sounds, but they should all be perfectly clear.

Fig. 5. Above-chassis view shows relative placement of all major components.

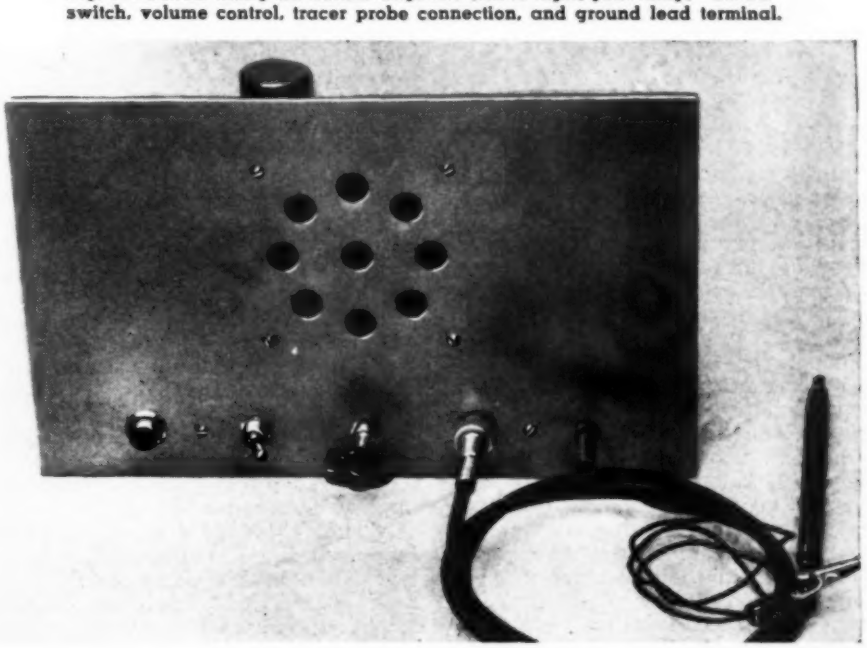
Let us now consider that you have constructed one of these instruments exactly according to instructions and are ready to put it to use. In most of the articles that have been written concerning signal tracers, it has been noted that these signal tracers will detune the circuit to which they have been applied. This fault either is not present in this signal tracer, or else it is of a negligible character. It has been noted that when the signal tracer probe is touched to parts of the circuits of a receiver under test, the signal in the loudspeaker of the receiver is lowered in volume, but that appears to be unimportant, as after all, the use of the signal tracer is to determine in which part of the circuit lies the trouble with the receiver. If we have a signal in the tracer it means that the receiver is in operation between the antenna and that point to which the tracer is connected.

This, of course, means that when the signal tracer is connected to any type of radio receiver, it will be sufficiently sensitive to detect the presence of signals at the antenna post of the receiver, or at the loop terminals if the receiver has a loop for signal pickup, instead of an antenna.

One precaution to be observed in

(*Continued on page* 145)

Fig. 6. Controls along the bottom edge are (left to right) pilot lamp, "On-Off" switch, volume control, tracer probe connection, and ground lead terminal.



A Wide Range EQUALIZING AMPLIFIER

By HARRY R. HYDER

A U-shaped piece of aluminum is used as a chassis for this home-built equalizer.

A phono equalizer for crystal or magnetic pickups, that provides both bass and treble boost.

ANYONE who has spent much time listening to phonograph records inevitably comes to the conclusion that modern recording and reproducing technique is not all that it should be. As far as recording goes, that is in the hands of the record manufacturers, and they are hampered by limitations in their recording equipment and record materials. So we, the listeners, are unable to approach the problem from that end, although we may rest assured that record manufacturers will continually improve their products as advances are made in that field.

But how about our end, the listening end? Is our reproducing equipment as good as it could be? Sound will be reproduced naturally when it contains only the original frequency components in their original proportions and when it is reproduced at the same amplitude level as originally transmitted. The first part of this statement means that our amplifier must have wide frequency range and low amplitude and intermodulation distortion. Most well-designed amplifiers satisfy these requirements. The second part of the statement is much more difficult to satisfy, as it is obviously impractical to reproduce in the home at the same level as in a symphony hall. Since decreases in level attenuate bass and treble frequencies more than middle frequencies, some compensation is obviously necessary.

Also, in recording, it is necessary to use volume range compression in order to keep soft passages from falling below the noise level of the record and loud passages from overloading the recording equipment. Various types of "volume expanders" have been devised to compensate for this at the listening end; but none can expand at exactly the same rate at which the compression took place, and most introduce considerable amplitude distortion; so all in all, they have not attained widespread use, and anyone interested in high-quality reproduction is advised to stay away from them. The amount of compression used on commercial discs does not seem too objectionable.

Now, assuming that our amplifier is "flat" and relatively distortionless over the audio range of 50 to 10,000 c.p.s., there are three things we must take into consideration for good reproduction: the record, the pickup, and the loudspeaker. We will discuss each of these in order.

There are two systems of disc recording, vertical and lateral. Since all commercial records are of the latter type, we will deal only with this system. By lateral is meant that the cutting stylus moves from side to side in accordance with the impressed sound wave, rather than up and down. Within this system, there are two methods of cutting; the "constant amplitude," and the "constant velocity."

In the "constant amplitude" method, the stylus moves a constant distance each side of center as the frequency varies, for a constant input level to the cutting head. The groove of a "constant amplitude" cut record of constant input level and varying frequency would look something like Fig. 1 (center).

In the "constant velocity" method, the cutting stylus moves with a constant lineal velocity as the frequency varies, for a constant input level to the cutting head. This means that as the frequency decreases, the stylus has to increase the width of its swings in order to maintain its velocity. In the constant amplitude system, the stylus is obviously moving with a greater lineal velocity at high frequencies than at the low frequencies, since it has to travel a fixed distance from center.

Now, recording experts disagree as to which of the two methods is the better. The constant amplitude system has the disadvantage that at the higher frequencies, the velocity is so great that the playback needle will not track. Also, record materials in common use cannot be cut accurately at high velocities. The constant velocity system has the disadvantage that at low frequencies, the amplitude of the swings of the stylus may be so great as to cut over into adjacent grooves. So the record companies have compromised, using constant am-

plitude at low frequencies where its advantages are greatest, and constant velocity at high frequencies where its advantages are greatest.

The point where constant amplitude cutting changes to constant velocity is variously known as the "crossover frequency" and "transition frequency." Usually, it is in the vicinity of 500 c.p.s. This affects reproduction in the following manner: Constant velocity is a characteristic of magnetic cutters and pickups, and constant amplitude is a characteristic of crystal cutters and pickups. If a record were cut constant amplitude with a crystal cutter and reproduced by a crystal pickup, the output would be substantially equal at all frequencies. This is likewise true in the case of a record constant velocity cut with a magnetic cutter and reproduced by a magnetic pickup.

On commercial records, however, where both methods of cutting are employed, neither a crystal nor a magnetic pickup will give "flat" output. The crystal pickup, being amplitude-sensitive, will lose output above the crossover frequency, and the magnetic pickup, being velocity-sensitive, will lose output below the crossover frequency. This loss will be approximately 6 db. per octave above the crossover frequency for the crystal pickup, and 6 db. per octave below the crossover frequency for the magnetic pickup. All this, of course, assumes perfect, "flat" cutters and pickups. Actually, resonances and other effects sometimes compensate in part for the differences, and sometimes do not. Clearly, something has to be done about this.

Leaving the input side of the amplifier, we will bypass the amplifier proper and go to the final bottleneck, the loudspeaker. It is practically impossible to predict performance of any particular loudspeaker. Many factors enter into the situation, among them being the baffle and the characteristics of the room in which the set is played. Some facts bear stating. The efficiency of a loudspeaker drops rapidly below its natural resonant frequency. The resonant frequency of a 5" speaker is about 180 c.p.s.; a 6" speaker, 140 c.p.s.; an 8" speaker, 100 c.p.s.; a 10" speaker, 75 c.p.s. and a 12" speaker, 50 c.p.s. This means a speaker at least 12" in size must be used to get good reproduction down to 50 c.p.s. The speaker, of course, must have an adequate baffle to keep the backward radiation of the speaker from cancelling the forward radiation.

In record amplifiers, extreme high-frequency response is not too important, since on an ordinary shellac pressing, the higher frequencies, above about 5000 c.p.s., are not recorded. The new plastic records extend the upper frequency limit to about 10,000 c.p.s. The only way to get response up to this point is by the use of an auxiliary high-frequency speaker, known as a "tweeter." But until plastic records become more plentiful, this is not necessary. Remember that we are dealing solely with the reproduction of commercial records. A dual speaker is definitely worthwhile for the reproduction of high-fidelity and FM broadcasts, where frequencies up to 15,000 c.p.s. are sometimes transmitted.

After reading all of the foregoing, one might get the idea that it is practically impossible to get accurate reproduction outside of a laboratory. As a matter of fact, accurate reproduction has not been achieved even in a laboratory. But quite good reproduction can be attained by intelligent compensation. Since we are largely ignorant of the exact characteristics of the equipment we use, there is only one approach which gives any promise of results. That is to provide our amplifier with a great variety of bass and treble compensations and to select that combination which pleases our ears, and our ears are ultimately the final judges.

To see what could be done along these lines, a unit was constructed to be used ahead of an already existing amplifier (actually the "phono" portion of a console radio having a 12" speaker). Ordinary "tone control" circuits were avoided, since they all get their effects by merely reducing the high-frequency response of the amplifier. This tends to make the set sound "dead" when the tone control is switched in. What was desired was a circuit that would leave the middle frequencies unaffected in level as the bass and treble compensation controls were varied. The boost is achieved by cascaded *RC* combinations. The bass boost is variable in four steps, giving 0, 2, 4 and 6 db. boost per octave respectively. This is adequate. More than this cannot be used, as hum and turntable rumble, being low frequency effects, are boosted along with the bass, an unfortunate but unavoidable situation. All of the boost takes place below 500 c.p.s., and the control is completely independent of the treble control. The treble boost is continuously variable and is achieved by inserting an *RC* network in the input

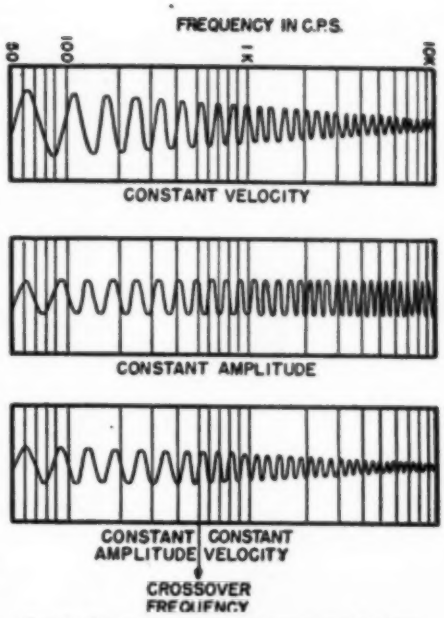


Fig. 1. Frequency response curves showing relative comparison of constant velocity and constant amplitude cut records. The crossover frequency is around 500 c.p.s.

which gives 6 db. boost per octave above 500 c.p.s., and then losing various portions of it across a variable *RC* low-pass filter in the output.

That idea worked very satisfactorily. Advancing the treble control to maximum gives a rather abrupt cut-off at about 5000 c.p.s. On worn records, where the scratch has become objectionable, this has proved a great help, since most of the scratch occurs above 5000 c.p.s. Contrary to popular belief, scratch does not take place at a particular frequency and cannot be filtered out by a resonant circuit. Rather, scratch increases with frequency. Brilliancy is bound to suffer with any limiting of high-frequency response, but this circuit keeps such a loss to a minimum. All this equalization results in a severe loss of gain, so a pentode voltage amplifier was included to make up for this. The gain of the unit itself is

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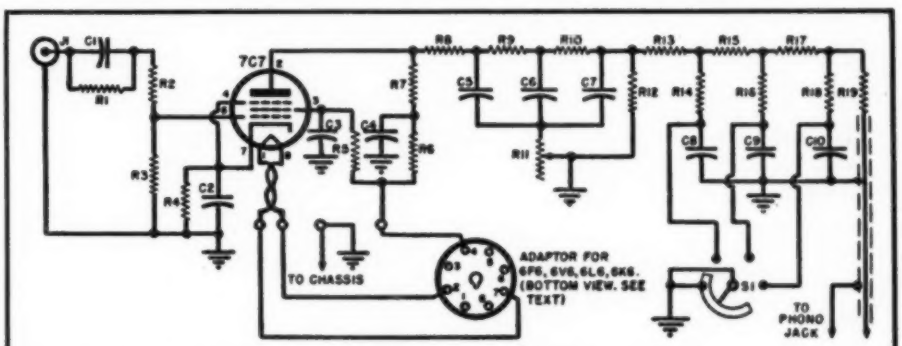
Fig. 2. Equalizer schematic. Gain at middle frequency is 1, at extreme ends, 100.

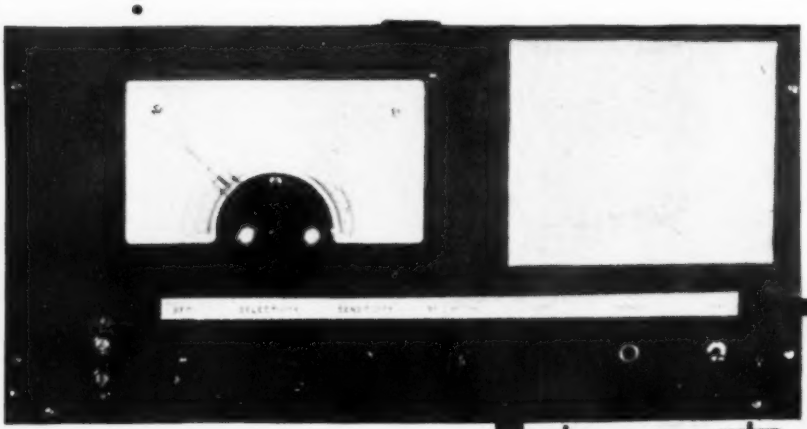


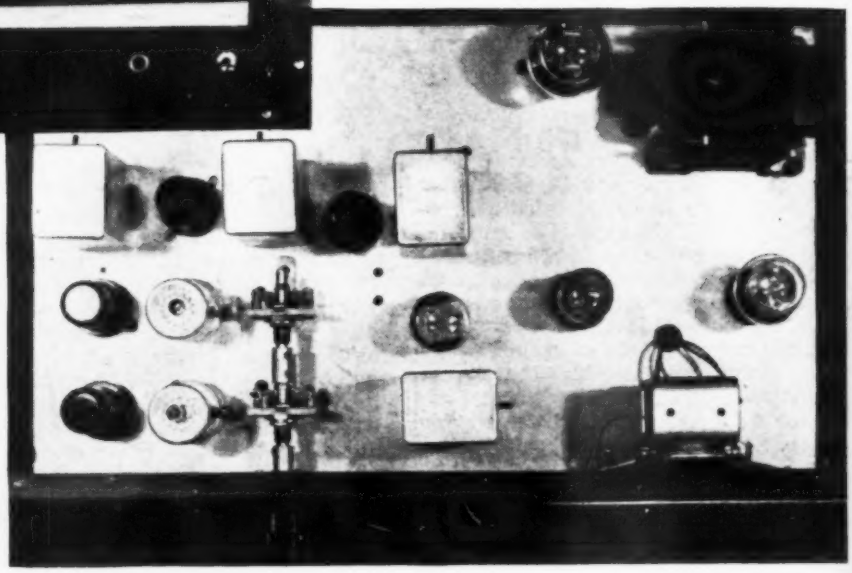
R_1—750,000 ohm, ½ w. res.
R_2, R_3, R_{13}, R_{15}, R_{17}—470,000 ohm, ½ w. res.
R_4—1500 ohm, ½ w. res.
R_5, R_{12}—1 megohm, ½ w. res.
R_6, R_8, R_9, R_{16}—47,000 ohm, ½ w. res.
R_7, R_{14}, R_{18}, R_{19}—270,000 ohm, ½ w. res.
R_{11}—500,000 ohm pot. (Treble control)
R_{10}—(See text)
C_1—750 μμfd. mica cond.
C_2—20 μfd., 25 v. elec. cond.
C_3—.05 μfd., 400 v. cond.
C_4—8 μfd., 450 v. elec. cond.
C_5, C_6, C_7, C_8, C_9, C_{10}—.002 μfd., mica cond.
J_1—Chassis connector
S_1—S.p., 4 pos. short circuiting type rotary sw. (Bass control) (See text)

A LOW-COST HAM RECEIVER

By NEWTON G. NOELL, W5OPW

The use of plug-in coils, combined with a regenerative 1600 kc. i.f., allows good ham band performance to be obtained at a minimum of cost.





(Left) Front view of the finished job, showing how it can be dressed up to present a finished appearance. Controls are, left to right, b.f.o. switch, S_{13}; selectivity, R_5; sensitivity, R_{10}; b.f.o. pitch, C_{16}; audio volume, R_{15}; phone jack, J_1; and stand-by switch, S_{14}. (Below) Top view of the chassis, showing parts placement. The r.f. section is in the lower left corner, with the oscillator tube and coil next to the panel. The i.f. stages are above the r.f. section, with the 6SL7 between the last i.f. transformer and the b.f.o. coil. The tubes to the right of the 6SL7 are the 6V6 and VR 105.

WITH the cost of living as high as it is today, the "ham budget" of the average amateur is very definitely limited. This, combined with the increased prices on lower-cost amateur receivers, makes it a good idea to design and build your own receiver when going after that ham ticket.

While the receiver to be described here is not the simplest design capable of satisfactory use, it is straightforward and should not present any great difficulties in construction. Features and cost have been held to the minimum possible consistent with satisfactory operation and high performance.

The receiver has ganged tuning, using the system outlined in the author's article, "A New Approach to Gang Tuning" (June, 1948, issue of RADIO NEWS, page 48), and has separate mixer and local oscillator tubes. By using this system, a full 180° of bandspread is obtained on all amateur bands, and the *National* vernier dial adds still further to the ease of separating stations in our present-day overcrowded bands. Because of its low noise and high gain, a 6AC7 was chosen for the mixer, and a 6C5 is used in the oscillator stage.

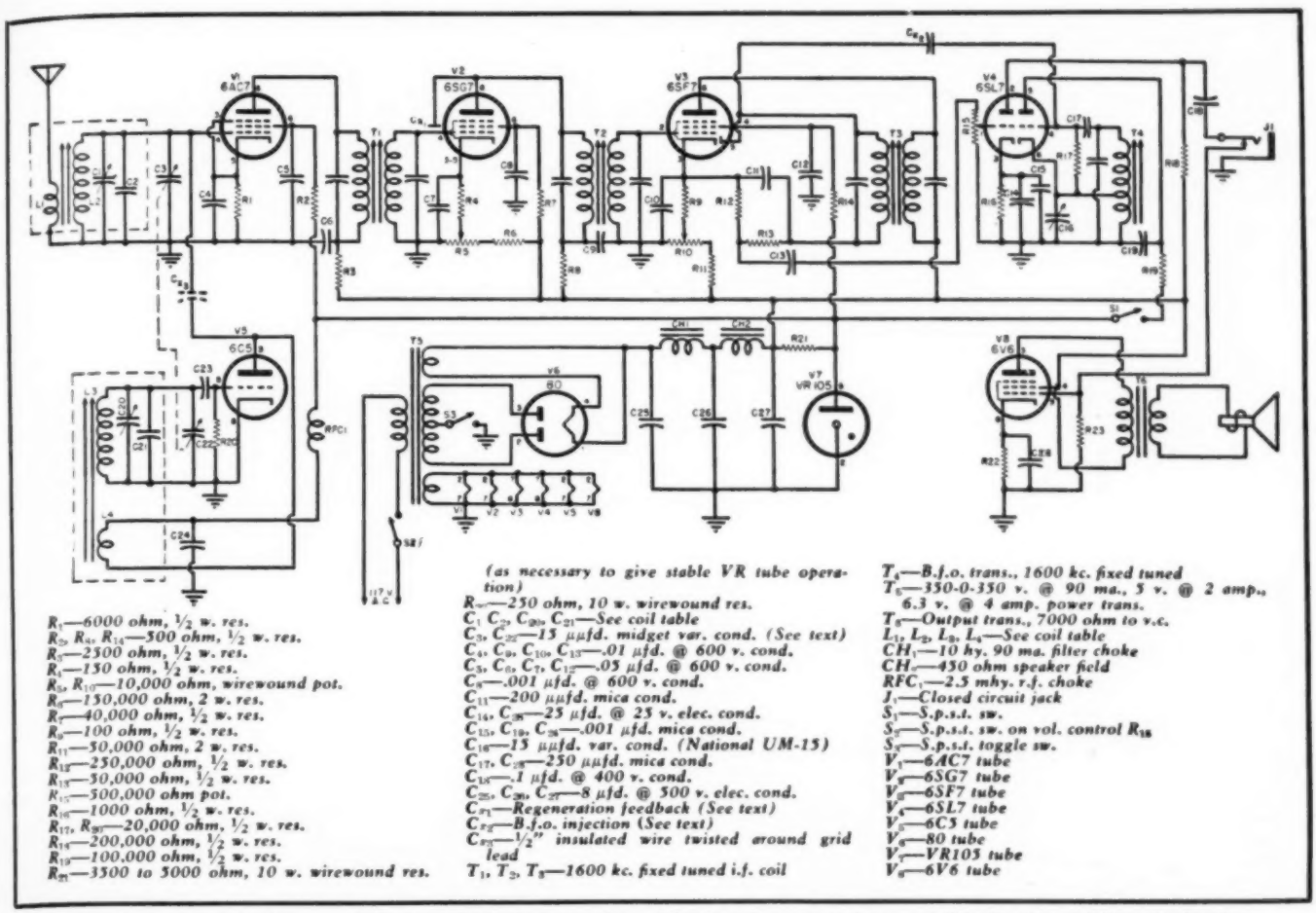
The i.f. stages operate at 1600 kc., the high frequency being chosen to reduce image response without the necessity of tuned r.f. stages ahead of the mixer. Since the bandwidth of a two-stage i.f. amplifier at 1600 kc. is approximately 12 kc. at two times down, the first stage is made regenerative to increase the selectivity. A 6SG7 is used in this stage, and the regeneration is accomplished by soldering a short length of stiff wire (C_{11}) to the plate pin and bringing it close to the grid. This stage has its own gain control, the regeneration and hence the selectivity being varied by it. The second i.f. stage is conventional, using the pentode section of a 6SF7.

For the detector, the diode section of the 6SF7 is used, and a.v.c. has purposely been omitted, since it could not be applied to the regenerative stage without having trouble with strong undesired signals adjacent to the weaker desired one. Under these circumstances, the stronger signal would reduce the gain, and hence the selectivity, thus making it impossible to pull the weaker one out of the heap. With only the second stage controlled by a.v.c., the effect is not great enough to warrant including it.

A 6SL7GT high-gain, twin triode is used for the first audio stage and beat frequency oscillator. A short length of insulated wire (C_{12}) soldered to the grid of the b.f.o. and wrapped around the diode detector plate pin serves to couple in the b.f.o. The audio output stage is a conventional single ended 6V6.

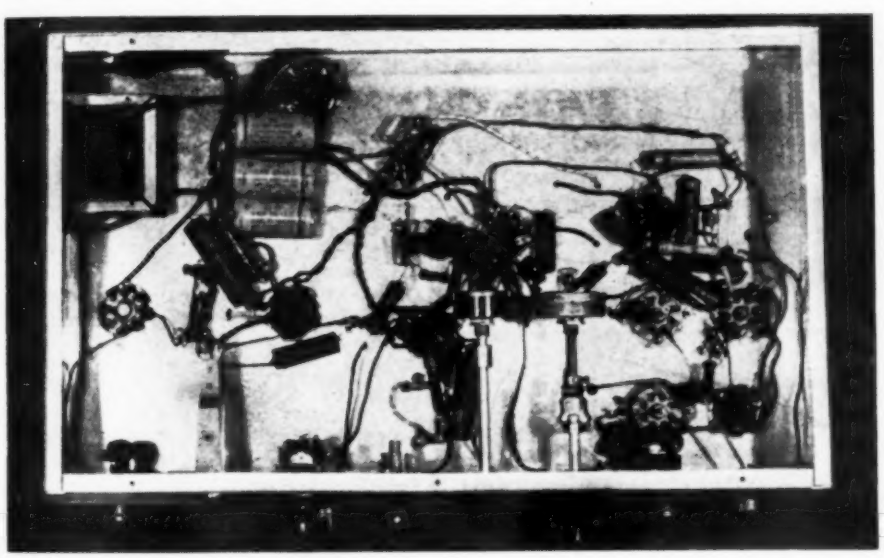
An OC3/VR105 voltage regulator tube is included in the power supply, and the regulated voltage is applied to both oscillator plates and the screens of the mixer and second i.f. stages. The screen of the 6SG7 in the first i.f. is fed through a series dropping resistor to extend the cut-off characteristic of this semi-variable mu tube. This is important if a stable receiver with positive acting gain and selectivity controls is to be obtained. The double pi section filter, using a ten hy. choke and the speaker field, reduces the ripple to a negligible value.

Built on a 10"x17"x3" aluminum chassis, the receiver is housed in a 9"x12"x18" crackle finished cabinet, the back panel of this cabinet being removed for better ventilation. There is ample room on the chassis for the addition of one of the small crystal



R_1—6000 ohm, ½ w. res.
R_2, R_4, R_{14}—500 ohm, ½ w. res.
R_3—2500 ohm, ½ w. res.
R_5—130 ohm, ½ w. res.
R_6, R_{10}—10,000 ohm, wirewound pot.
R_8—150,000 ohm, 2 w. res.
R_9—40,000 ohm, ½ w. res.
R_{12}—100 ohm, ½ w. res.
R_{11}—50,000 ohm, 2 w. res.
R_{13}—250,000 ohm, ½ w. res.
R_{15}—30,000 ohm, ½ w. res.
R_{16}—500,000 ohm pot.
R_{18}—1000 ohm, ½ w. res.
R_{17}, R_{20}—20,000 ohm, ½ w. res.
R_{19}—200,000 ohm, ½ w. res.
R_{21}—100,000 ohm, ½ w. res.
R_{22}—3300 to 5000 ohm, 10 w. wirewound res. (as necessary to give stable VR tube operation)
R_{23}—250 ohm, 10 w. wirewound res.
C_1, C_2, C_{20}, C_{21}—See coil table
C_3, C_{22}—15 μμfd. midget var. cond. (See text)
C_4, C_9, C_{10}, C_{13}—.01 μfd. @ 600 v. cond.
C_5, C_6, C_7, C_{12}—.05 μfd. @ 600 v. cond.
C_8—.001 μfd. @ 600 v. cond.
C_{11}—200 μμfd. mica cond.
C_{14}, C_{26}—25 μfd. @ 25 v. elec. cond.
C_{15}, C_{19}, C_{28}—.001 μfd. mica cond.
C_{16}—15 μμfd. var. cond. (National UM-15)
C_{17}, C_{18}—250 μμfd. mica cond.
C_{18}—.1 μfd. @ 400 v. cond.
C_{25}, C_{30}, C_{27}—8 μfd. @ 300 v. elec. cond.
C_{31}—Regeneration feedback (See text)
C_{32}—B.f.o. injection (See text)
C_{33}—½" insulated wire twisted around grid lead
T_1, T_2, T_3—1600 kc. fixed tuned i.f. coil
T_4—B.f.o. trans., 1600 kc. fixed tuned
T_5—350-0-350 v. @ 90 ma., 5 v. @ 2 amp., 6.3 v. @ 4 amp. power trans.
T_6—Output trans., 7000 ohm to v.c.
L_1, L_2, L_3, L_4—See coil table
CH_1—10 hy. 90 ma. filter choke
CH_2—430 ohm speaker field
RFC_1—2.5 mhy. r.f. choke
J_1—Closed circuit jack
S_1—S.p.s.t. sw.
S_2—S.p.s.t. sw. on vol. control R_{18}
S_3—S.p.s.t. toggle sw.
V_1—6AC7 tube
V_2—6SG7 tube
V_3—6SF7 tube
V_4—6SL7 tube
V_5—6C5 tube
V_6—80 tube
V_7—VR105 tube
V_8—6V6 tube

Complete schematic diagram of the home-built, ham receiver. Plug-in coils are used to cover 80-, 40-, 20-, and 10-meter bands.



Bottom view showing parts layout and wiring. All r.f. leads should be kept as short as possible and bypass condensers placed adjacent to points bypassed.

frequency standards that are now on the market.

If possible, a split-stator tuning condenser should be used for the sake of mechanical stability. If this is not available, use single bearing midgets with *long* bearings and gang them with a rigid shaft coupling. All signal carrying leads in the r.f. and oscillator sections are of No. 14 wire for further rigidity.

When the receiver was first designed, some difficulty was experienced with images even on eighty meters, and broadcast stations on the i.f. frequency would feed right on through. This indicated too close coupling between primary and secondary of the r.f. coils. Increasing the spacing between the windings completely eliminated the undesired signals, so it is recommended that the physical dimensions of the coils be followed exactly as given in the table shown on following page. Details on both r.f. and oscillator coils are given.

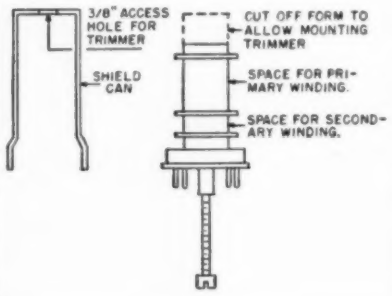
All coils are wound on Millen No. 74001 slug-tuned forms, using No. 30 enameled wire. Low-drift tubular ceramic condensers are used for padding the tuned circuits, with silver ceramic trimmers shunted across them for alignment purposes. One-half inch is cut off the polystyrene tube of each form, and an access hole is drilled in the shield to allow mounting these condensers inside the shields. Pins 1 and 2 on all coils should be grounded for added stability. These pins connect to the shield can and tuning slug respectively.

The placement of the major parts as shown in the photos should be followed rather closely. Provided the tube sockets are properly oriented, this arrangement will give short signal leads and good electrical separation without shielding. Gain and selectivity controls are mounted on brackets adjacent to the stages they control, and extension shafts are brought out to the panel.

Alignment of the i.f. stages should be done first with the regeneration feedback coupling out of the circuit entirely. When the stages are aligned and perking without any stray feedback, this wire may be soldered in and the stages repeaked with the selectivity control set so that the 6SG7 is on the verge of oscillation. The position of the feedback wire, C_{31}, rela-

BAND	R.F. SECTION		OSCILLATOR SECTION	
	L_1	L_2	L_3	L_4
80 METER	5 t. #30 en. close-wound ⅛" from cold end of L_1	80 t. #30 en. spaced to 1" C_1—3-30 μμfd. trimmer C_2—Omit	40 t. #30 en. spaced to ¾" C_{20}—3-30 μμfd trimmer C_{21}—25 μμfd. silver mica or tubular ceramic	7 t. #30 en. close-wound on top of cold end of L_3
40 METER	5 t. #30 en. close wound ⅛" from cold end of L_1	20 t. #30 en. spaced to ¾" C_1—50 μμfd. trimmer C_2—100 μμfd. silver mica or tubular ceramic	15 t. #30 en. spaced to ¾" C_{20}—50 μμfd. trimmer C_{21}—150 μμfd. silver mica or tubuler ceramic	5 t. #30 en. close-wound ⅛" from cold end of L_3
20 METER	3 t. #30 en. close-wound ⅛" from cold end of L_1	8 t. #30 en. spaced to ¾" C_1—80 μμfd. trimmer C_2—150 μμfd. silver mica or tubular ceramic	7 t. #30 en. spaced to ¾" C_{20}—50 μμfd. trimmer C_{21}—200 μμfd. silver mica or tubular ceramic	4 t. #30 en. close-wound ¼" from cold end of L_3
10 METER	3 t. #22 en. close-wound ⅛" from cold end of L_1	3½ t. #22 en. spaced to ½" C_1—80 μμfd. trimmer C_2—25 μμfd. silver mica or tubular ceramic	3½ t. #22 en. spaced to ⅜" C_{20}—80 μμfd. trimmer C_{21}—25 μμfd. silver mica or tubular ceramic	2 t. #22 en. close-wound on top of cold end of L_3

All coils wound in same direction on *Millen* #74001 coil forms, with ½" cut off top end of form and a ⅜" hole drilled in center of the top of the shield for mounting and to provide access to trimmers.


3/8" ACCESS HOLE FOR TRIMMER
SHIELD CAN
CUT OFF FORM TO ALLOW MOUNTING TRIMMER
SPACE FOR PRIMARY WINDING.
SPACE FOR SECONDARY WINDING.

Oscillator and r.f. coil data. Diagram shows modifications made on Millen forms.

tive to the grid of the tube, should be adjusted so that this point of maximum selectivity occurs with the control about three-fourths of the way clockwise. The b.f.o. tuning condenser may then be meshed half way and the b.f.o. coil aligned with its slug.

Tracking the r.f. and oscillator coils is not exactly a straightforward procedure, but it shouldn't present any great difficulties. The station v.f.o., or a very accurately calibrated signal generator, should be used. If the v.f.o. is used, the beat oscillator should be turned on; the tuning can then be done by ear, or with an output meter. The use of an output meter is recommended because of the lack of sensitivity of the human ear.

The oscillator is first adjusted to cover the desired range by setting the signal generator on the lower end limit of the band being tracked in. The oscillator coil slug is adjusted until the signal is heard with the dial set at about 95 on the linear scale. The signal generator is then set on the upper end limit of the band, and the receiver tuned upward until the signal is again heard. If this occurs at 5 on the linear dial scale, all is well. If it doesn't, adjust the oscillator trimmer to bring it in. Both ends of the band should then be rechecked several times, as there is a noticeable interaction.

To be sure that you haven't aligned the oscillator with an image or a harmonic of the signal generator, it is a good idea to keep the signal generator output as low as possible. It is also suggested that you follow the signal with the receiver as the signal generator is tuned from one end of the band to the other at least once during the procedure.

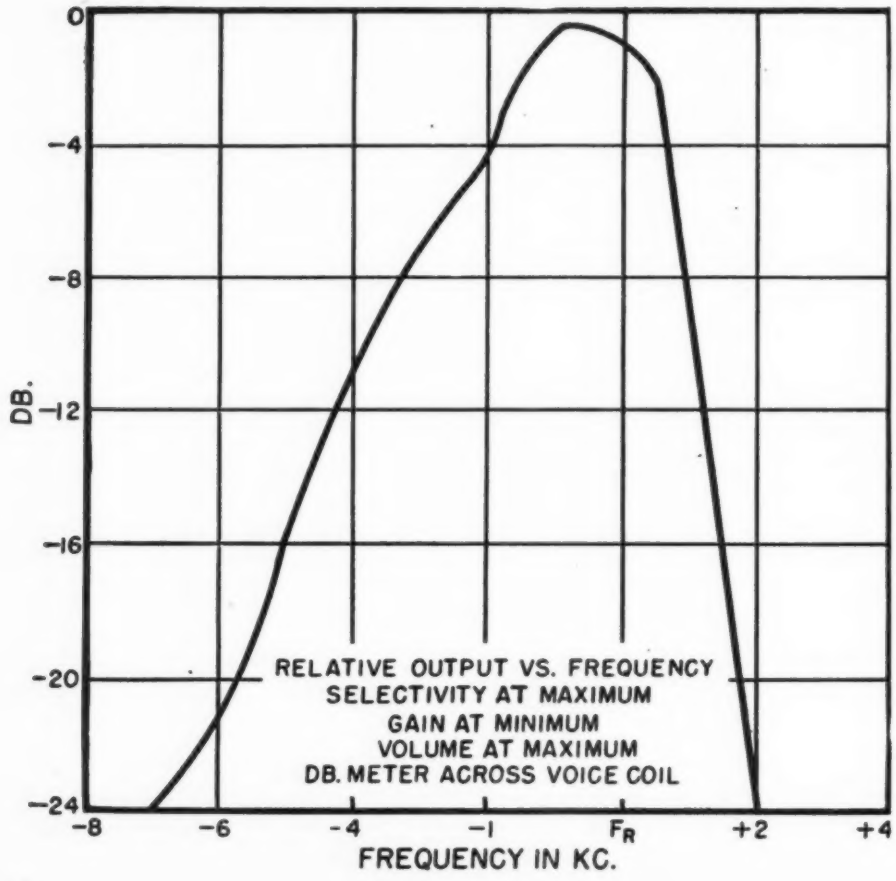
After the range of the oscillator has been set as described, the r.f. coil is aligned by adjusting its slug at the low end, and its trimmer at the high end of the band, repeating several times as before, until correct tracking is obtained. A little patience spent in following this alignment procedure word for word will really pay off in the final results. After the tracking is completed, the slug adjusting screws should be sealed with a little *Duco* cement.

At W5OPW, the receiver is operated with the selectivity control set at maximum (without the i.f. oscillating, of course) and gain adjusted with the sensitivity and volume controls. After we had discovered that the sidebands could be chopped off a phone signal, it was decided to run a selectivity curve on the receiver. The curve shows a bandwidth of about three kc. at 6 db. down, ample selectivity for most receiving conditions. The lack of symmetry in the curve is characteristic when regeneration is used to improve selectivity, and gives a decided single-signal effect.

The total cost of the receiver, if all parts are bought new, is just under $60, and we have yet to see a commercially-built job at half again this price which will measure up to it in selectivity, sensitivity, or stability.

The performance of this receiver is equivalent to most of the better commercial jobs on all but the ten meter band. This falling off in performance is probably due to the lead lengths in the front end. If peak performance is desired on the 10-meter band it might be well to use a converter. —30—

Selectivity curve—a bandwidth of 3 kc. is obtained at 6 db. down.



Self-Supporting Towers for TV ANTENNA ARRAYS

By LYMAN E. GREENLEE

In many locations fringe-area TV reception is improved by increasing antenna height. A well-constructed tower, using thinwall conduit, can be built at a reasonable cost.

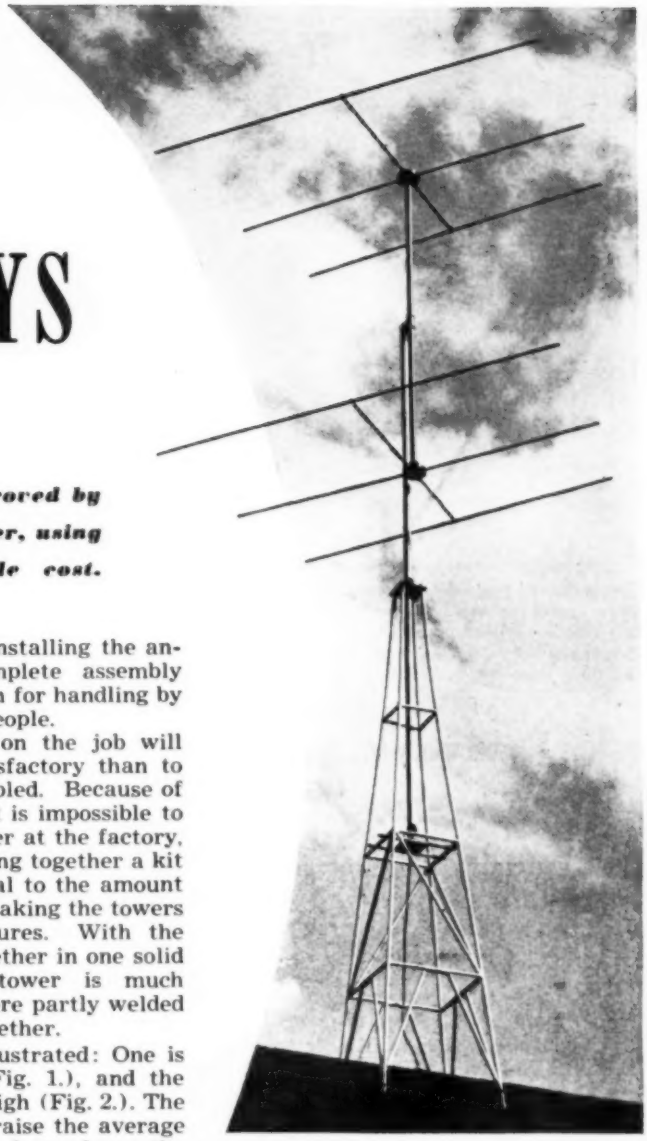


Fig. 1. This 10-foot tower supports a Workshop television antenna array.

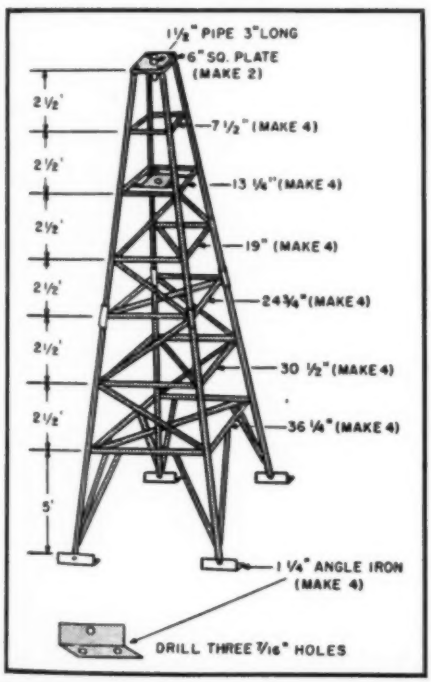
TO GET any satisfactory television reception in marginal areas where the nearest TV transmitter is beyond the range of primary coverage (usually about 25 miles), an antenna array must be installed so that it rises above all immediately surrounding objects. To raise an antenna up above trees and other houses in the immediate vicinity is often quite a problem, particularly in view of the fact that repairs may be necessary from time to time. The ideal solution is a climbable tower, or one that is hinged at the base so it can be tipped over for necessary repairs. Weight and ease of handling are important factors, because it certainly is not always convenient to call on the neighbors for help in repairing or installing the antenna, and the complete assembly should be light enough for handling by not more than two people.

To build a tower on the job will usually be more satisfactory than to buy one partly assembled. Because of shipping difficulties, it is impossible to assemble a large tower at the factory, and the work of putting together a kit of parts is about equal to the amount of labor involved in making the towers shown in these pictures. With the pieces all welded together in one solid unit, the finished tower is much stronger than if it were partly welded and partly bolted together.

Two towers are illustrated: One is a ten-foot section (Fig. 1.), and the other is twenty feet high (Fig. 2.). The ten-foot section will raise the average array about twenty feet above the roof, and the twenty-foot section can easily be extended with a piece of tubing to a total height of thirty feet. Material used in construction is half-inch thinwall conduit, which is readily obtainable everywhere at low cost. One man can carry the completed ten-foot section and the antenna array up on to the roof by himself, and two men will easily be able to handle the twenty-foot section. By loosening two bolts, either the ten- or the twenty-foot section may be tipped over for service and easily raised back in place by two men. The finished tower is climbable, however, and it is possible for two men to climb the twenty-foot section and work on it at the same time.

Dimensions of the various parts of the tower are shown in the drawing. These should be cut from half-inch thinwall tubing, with the braces made a little long and the ends ground to fit. Corner pieces are ten-foot lengths of thinwall tubing. Flatten one end of each corner piece, and drill a ⅜" hole for the angle iron support. Cut four feet from 1¼" angle iron, and drill three holes in each one as is shown in the sketch. Then, cut a 6" square plate for the top of the tower, and drill four holes to take the half-inch tubing and a large center hole for the section of 1½" pipe that forms an upper bearing for the antenna mast. Make a cup for the lower end of the antenna mast, or a motor mount if the antenna is to be rotated by power; otherwise it can be turned by hand. Large cotter pins may be used to hold the mast in place.

Fig. 2. Construction details of a 20-foot tower, using ½" thinwall conduit. All joints are brazed solidly with brass.



All joints should be carefully brazed, and care should be taken to avoid burning the thin tubing. To assemble the pieces, select a smooth concrete floor, walk, or driveway, and start with one side holding the parts in place while you make small tack welds. Tack all of the parts together so that they may be cut loose if a mistake is made, then true up the entire assembly. Use a hammer and large pipe wrench to bend the parts wherever necessary, so that you will have a straight, true tower that will look right when it is assembled.

After the parts are tacked together,

(*Continued on page* 139)

MODERN Television RECEIVERS

Conventional type deflection yoke used on all electromagnetic deflection tubes. It is mounted on the neck of the tube near the bulb end.

A horizontal width control shown as part L_2 in Fig. 7.

By MILTON S. KIVER

Part 19. Horizontal sweep systems for electromagnetic deflection tubes—their operation and how they differ from those used with electrostatic tubes.

WHILE vertical sync systems are quite simple and readily analyzed, the circuit used in the *Motorola* Model VT-71 television receiver (shown in Fig. 1) does not appear, at first glance, to fit within the category of blocking oscillators or multivibrators. Actually, we have a multivibrator here, although tube V_1, labeled as the vertical sweep oscillator, comprises only half of this circuit. The other half is supplied by V_{2A}, this being one triode section of a 6SL7. In addition, V_{2A} also functions as one half of the push-pull vertical output amplifier, feeding the saw-tooth deflecting voltage to one vertical plate in the 7JP4 cathode-ray tube. The other half of V_2 (here, V_{2B}) receives a portion of the saw-tooth voltage from V_{2A}, amplifies and inverts it, and then transfers it to the other vertical deflecting plate of the 7JP4 image tube.

In detail, the circuit functions as follows. The vertical synchronizing pulse received on the grid of V_1 locks V_1 and V_{2A} into synchronization with the television station, and a saw-tooth wave is generated across C_1. This wave is amplified and inverted by V_{2A}, then differentiated by C_2 and R_1, providing a pulse corresponding to the retrace portion of the saw-tooth wave. The pulse is filtered by C_3 and R_2 to remove horizontal and interference pulses and then is passed through C_4 back to V_1. This completes the multivibrator circuit.

Condenser C_1 charges in a fairly linear manner during the interval when V_{2A} is kept cut-off by the negative pulse fed back through C_3, R_2, and C_4. The negative charge across C_4 leaks off slowly through R_3 and R_4. The incoming vertical sync pulse, which is positive in polarity, then triggers V_1 just a little before it would trip itself naturally. When V_1 conducts, C_1 discharges rapidly through the relatively low resistance of V_1. By making R_4 variable, we can control the rate at which the charge across C_4 leaks off and, thereby, the oscillator frequency. Consequently, this represents the vertical hold control. A vertical size control (height) regulates the peak voltage to which C_1 charges.

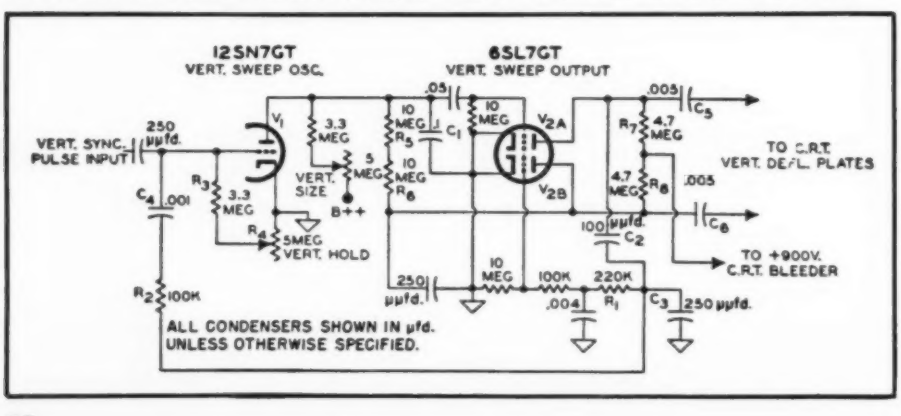
Push-pull amplification of the saw-tooth deflection voltage is afforded by both triode sections of V_2. The normal "B+" voltage, however, is insufficient to provide a linear vertical sweep over the range required to swing the electron beam completely across the face of the image tube. Therefore, V_2 is made part of the high voltage bleeder string, with approximately 900 volts being applied at the positive end of the plate load resistors. Of this, only 275 volts actually reaches the plates of the 6SL7.

Since C_5 and C_6 are of too low a value to pass the saw-tooth wave without distortion, R_5 and R_6 introduce feedback, which pre-distorts the wave in the opposite direction, so that the resulting wave applied to the deflection plates is linear.

When servicing this particular vertical system, or others like it, it is well to keep in mind two facts. First, that the plate voltage for V_2 is obtained from the high-voltage bleeder chain, and second, that vertical linearity is dependent upon the proper operation of the feedback path containing R_5 and R_6. A common defect arising from the first consideration is the appearance of a defocused image on the screen possessing about one-fourth its usual height. Rotation of the vertical size control does not appreciably increase the vertical height of the image, nor is it possible to bring the image into sharp focus by adjustment of the focus control.

If the voltage at each plate of V_2 is measured, it will be found to be about

Fig. 1. The unusual vertical sweep system used in Motorola VT-71 television receivers.



30 volts, which is far below its normal value of 275 volts. A waveform check at these two points will indicate a saw-tooth wave that rises only slightly and then tapers off. The low plate voltage is obviously the fault here and it may either be due to a decreased output from the high-voltage power supply or a significant change in resistance values in the bleeder chain resistors. We can check the output voltage of the high-voltage power supply roughly by examining the intensity of the image on the screen. Any significant decrease in accelerating voltage will reduce the image intensity considerably or even prevent the electron beam from reaching the screen at all.

If the high voltage is okay, then the resistance values at some point along the bleeder chain have changed considerably. Usually this occurs in R_7 and R_8 (Fig. 1), and when these resistances are replaced, the set functions normally again. This particular trouble was analyzed in detail because it occurs frequently in sets where the plate load resistors of the vertical output amplifier are incorporated into the high-voltage bleeder chain. This is true of such sets as *Sentinel* Models 400-TV and 405-TVM, the *Tele-Tone* a.c.-d.c. 7-inch receiver, *Temple* receivers, and *Admiral* Model 19A1 sets.

The second defect, poor vertical linearity, can usually be traced either to a defective tube, V_2, or a significant change in the values of R_5 or R_6.

Horizontal Sync Systems

Horizontal sync systems in receivers using the 7-inch electrostatic cathode-ray tube are almost identical (except for slight variations to be noted presently) with vertical systems previously described. Fig. 2 affords a comparison of the vertical and horizontal sweep systems in the *Tele-Tone* Model 149 television receiver, and it is readily seen that if the identifying names were removed, it would be difficult to distinguish between the two. As before, either multivibrators or blocking oscillators may be employed to sweep the beam across the screen and the shapes of the waveforms likewise remain unchanged. The only point to remember when checking waveforms in the horizontal system is the higher frequency (15,750 cycles) of the voltages. This requires that the sweeping frequency of the oscilloscope be altered accordingly. Aside from this, however, the waveform test procedure is identical with the method previously outlined.

A variation that is employed by some manufacturers is the use of chokes or tapped transformers as the plate load impedances for the horizontal output amplifiers. See Fig. 3. The use of these units is possible because at 15,750 cycles, a choke can be designed which is economical and, at the same time, possesses sufficient impedance to develop the necessary output voltage required to swing the beam across the entire screen of the tube.

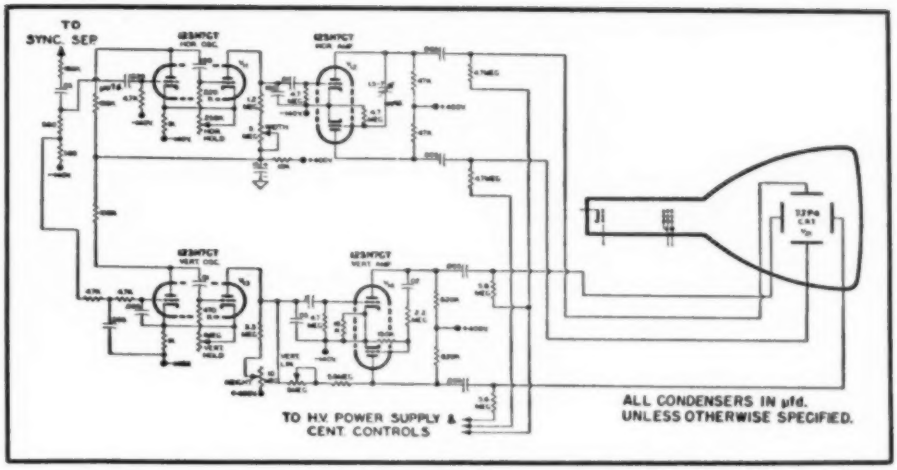


Fig. 2. The vertical and horizontal sweep systems in the Tele-Tone Model 149 television receiver. Note the similarity of the two sections.

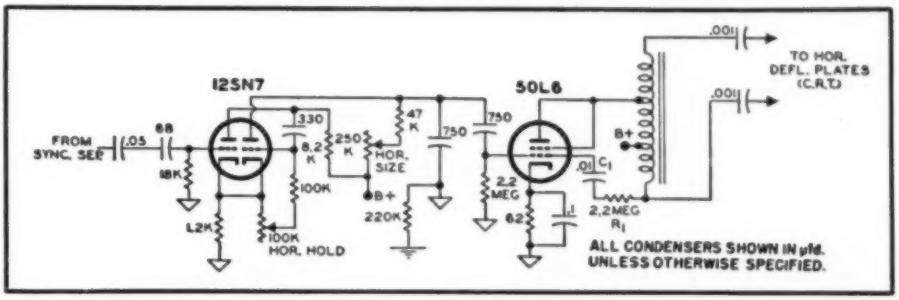


Fig. 3. A horizontal electrostatic deflection system using an output autotransformer.

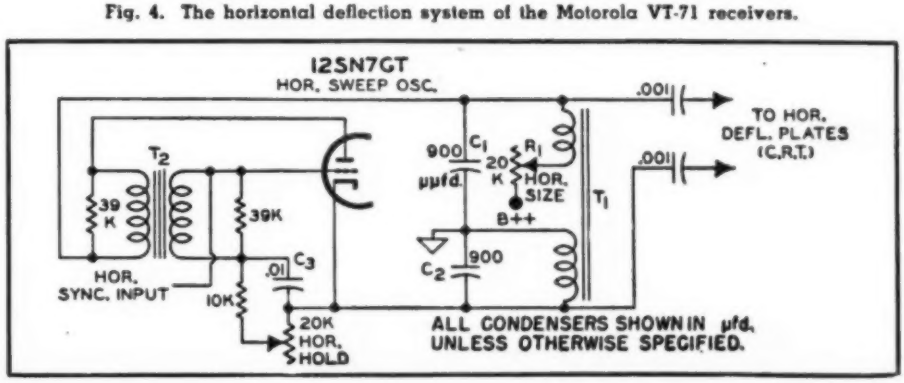
Since the windings of the choke or transformer have relatively little d.c. resistance, more voltage is made available directly at the tube and, hence, an increased output is obtained. Furthermore, where necessary, the plate load can be an auto-transformer, providing some step-up in voltage. This is the method employed in the circuit of Fig. 3 and although some distortion is produced, this is overcome by the feedback network, condenser C_1 and resistor R_1, giving a final output which is fairly linear.

Before we leave the subject of horizontal sweep systems in electrostatic deflection circuits, it might be worthwhile to analyze the operation of the horizontal deflection system currently being employed in *Motorola* VT-71 television receivers. The circuit, shown in Fig. 4, contains a single tube which not only functions as the sweep oscillator, but which also presents a push-pull output voltage that is applied directly to the plates of the cathode-ray tube, eliminating the need for an output amplifier. In order to understand how the circuit functions, let us analyze its operation in piece-meal fashion.

The circuit of V_1 is that of a blocking oscillator, but further analysis reveals that the plate and cathode are both arranged symmetrically with respect to ground. This differs from the conventional arrangement where the cathode connects directly to ground. By using the method of Fig. 4 we obtain a symmetrical or push-pull output voltage to drive the 7JP4 tube.

Connected across the tube, between cathode and plate, is a resonant circuit composed of two fixed condensers and two windings of transformer T_1. Tube V_1, operating as a blocking oscillator, acts like a low impedance switch which is opened and closed at

Fig. 4. The horizontal deflection system of the Motorola VT-71 receivers.



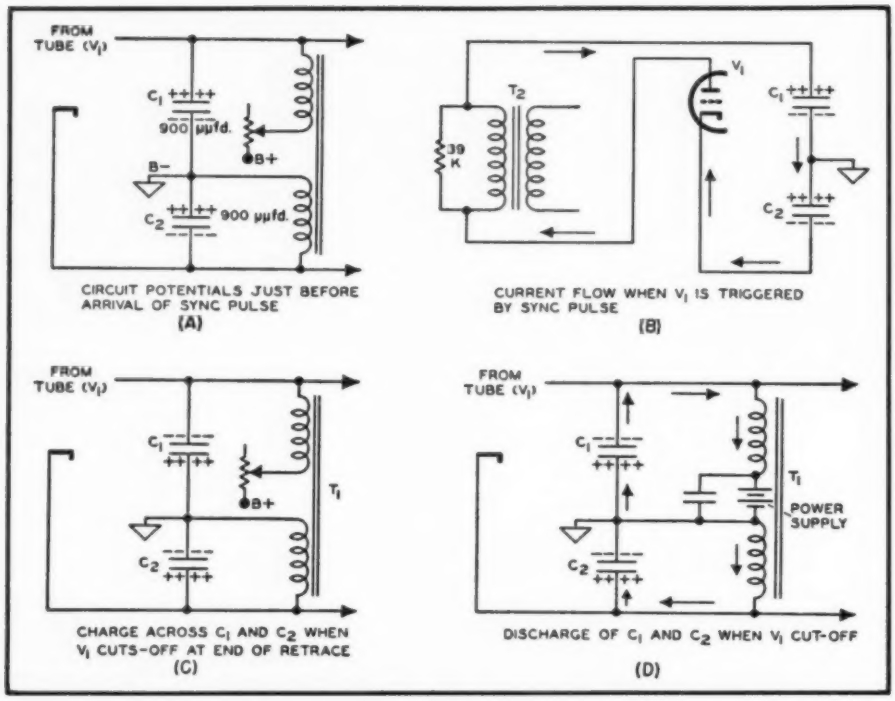


Fig. 5. Various stages in the operating cycle of horizontal oscillator shown in Fig. 4.

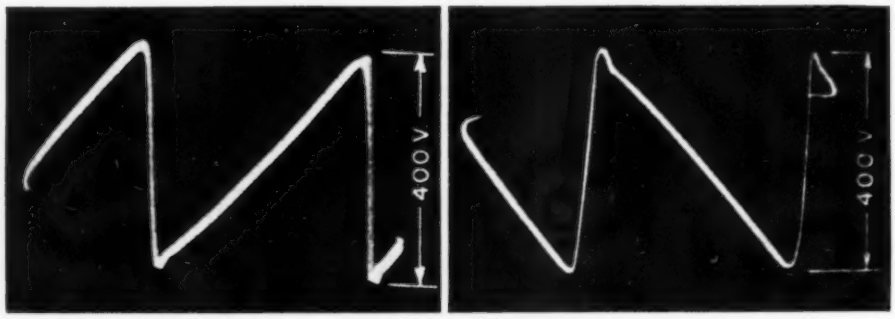


Fig. 6. Waveform at left shows voltage variations across C_1 of Fig. 4; waveform at the right shows the voltage variations across C_2 of Fig. 4.

the line repetition rate of 15,750 times per second. The open time, during which the tube is cut-off and does not conduct, corresponds to the sweep across the image screen. During this time, condenser C_1 receives a constant current and charges in a positive direction. During the same interval, condenser C_2 receives the same constant current, but charges in a negative direction. Therefore, with respect to ground (or "B−" here), both condensers are charging in opposite directions, providing the desired push-pull output. Fig. 5A shows the circuit just before the arrival of a sync pulse, with C_1 and C_2 possessing the potentials just noted.

Upon the arrival of a positive horizontal sync pulse to the grid of V_1, the tube is driven sharply into conduction, effectively placing a low resistance path across the two charged condensers, C_1 and C_2. Electrons flow from the bottom of C_2, through the tube and secondary of T_2 into C_1, and from the bottom plate of C_1 back to C_2 again. (See Fig. 5B.) This vigorous current flow makes C_1 negative with respect to "B−" and C_2 positive. This pulse of plate current is short, lasting for approximately seven microseconds, after which the grid of the tube becomes blocked by the negative charge developed across C_2. (The arrival of the sync pulse caused grid current to flow, and these electrons piled into C_2. When the voltage fed back from the plate winding to the grid winding of T_2 is no longer able to overcome this negative accumulation of electrons, the tube is forced sharply into cut-off.)

When the tube suddenly stops conducting, C_1 and C_2 are left with the charge indicated in Fig. 5C. Now a discharge path exists through the windings of T_1, and the condensers start to discharge through the windings in the manner shown in Fig. 5D. Due to the relatively high inductance of these windings (they can really be represented as two iron-cored chokes), the discharge of condensers C_1 and C_2 is slow, resulting in a linear current. Electrons flow from C_1 through the two windings to C_2 and then from the other plate of C_2 back to C_1 again. During this discharge, the potential across C_1 is rising in a positive direction (actually, of course, it is losing electrons) while the potential across C_2 is rising in a negative direction (gaining electrons). Energy is supplied by the "B+" power supply to sustain the flow of current through the circuit and to compensate for any losses due to resistance in the circuit path. The discharge of C_1 and C_2 continues until the arrival of the next horizontal sync pulse, when the tube is driven sharply into conduction and the flow of electrons from V_1 neutralizes and reverses the potentials across C_1 and C_2. This reversal of charge across the two condensers constitutes the rapid retrace period. When the tube drops back into cut-off again, the two condensers start discharging through the windings of T_1.

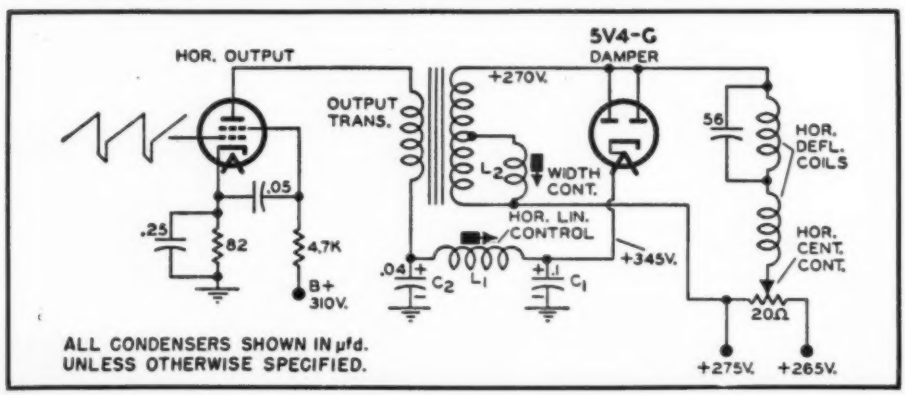
Confirmation of this operation is indicated in the oscillograms showing the voltage variations appearing across C_1 and C_2. See Fig. 6. Application of these voltages is then made directly to the horizontal deflection plates of the 7JP4 image tube. Due to the use of a resonant circuit, the "B+" supply voltage of 250 volts is built up to a peak-to-peak deflection voltage of about 800 volts.

Resistor R_1 is made variable in order to permit adjustment of the width of the picture. As its resistance is increased, the amount of current reaching C_1 and C_2 is reduced, with a subsequent decrease in the voltage variations appearing across these condensers. By this means, the voltage at the deflecting plates is made variable, permitting control of the picture size.

While the transition from vertical

(*Continued on page* 142)

Fig. 7. A horizontal output stage adapted for electromagnetic deflection.



RHOMBIC ANTENNAS For Television

By WOODROW SMITH
Author, "The Antenna Manual"

For fringe and bad ghost areas the rhombic antenna will always outperform an ordinary dipole array.

THE rhombic antenna has for many years been a favorite for high-frequency sky-wave transmission and reception. This is explained by its simplicity of construction as compared to dipole arrays having comparable gain, by its broadband characteristics, and by its sharp, unidirectional directivity pattern throughout its broad frequency range.

The same characteristics which recommend the rhombic array for high-frequency sky-wave applications make it an ideal TV receiving antenna for use in fringe areas or bad ghost areas when sufficient room for erection is available, particularly when several stations lie in very nearly the same direction.

Even when the desired stations do not lie in approximately the same direction, the rhombic array often will be found useful in providing a usable picture on one channel at distances so great that an ordinary dipole array will not perform, or in providing a useful picture on one channel in mountainous areas where ghosts are so bad that a ghost-free picture cannot be obtained on even one channel with an ordinary dipole array.

Rhombic Characteristics

Unlike an ordinary dipole array using one or more parasitic elements, a rhombic array exhibits a good front-to-back ratio *over a wide frequency range* and also has a very narrow acceptance angle off the front side. This means good rejection of ghost-producing reflected signals on all channels, both from the side and off the back.

The wide acceptance angle of conventional dipole arrays makes them highly vulnerable to ghost-producing echo signals arriving *obliquely from the front side*. Contrary to widespread belief, ghosts are not necessarily produced by echo signals arriving from the back side of an antenna; they often arrive from the front.

Front side echo signals sometimes are not apparent as ghosts, because they may have a comparatively short delay time. Under such conditions a separate image is not discernible; the echo signal simply degrades the definition of the picture without producing a separate image.

A high-frequency rhombic array may be designed for effective sky-wave transmission or reception over a frequency range as great as 4 to 1. While the vertical angle of maximum radiation or response of such a rhombic increases considerably with decreasing frequency over such a wide frequency range, higher angles become effective as the frequency is lowered. Therefore, the change in vertical directivity is not particularly objectionable for sky-wave applications.

The situation is different, however, in the case of TV reception or other v.h.f. ground wave applications. The only effective vertical angle is that of the angular elevation of the horizon at a point where the arriving wave passes over it. There is only *one* useful vertical angle, and this angle does not change with frequency. The only useful gain is that which occurs at this angle.

As a result, the useful frequency range of a rhombic array designed for TV reception or other v.h.f. applications does not exceed approximately 2 to 1, and preferably the range should not exceed 1.6 to 1. This means that it is not possible to design a rhombic array which will provide near-optimum performance on both the low and high television bands. The ratio of 216 mc. to 54 mc. is 4 to 1, and any attempt to cover this range with a single rhombic array will result in mediocre performance over much of the range.

Where two-band coverage is required, a high-band rhombic can be strung inside a low-band job from the same poles. The separation will be sufficient to avoid undesirable interaction. For short runs separate feed lines and a suitable switch should be employed. For long runs a d.p.d.t. relay can be placed at the antenna end and a single line run from the relay to the set.

Design Dimensions

Design data are given in Fig. 1 for four rhombics: (1) a long-leg rhombic for use on the low band for maximum gain and directivity where space permits; (2) a short-leg rhombic for use on the low band when space restrictions will not permit a long-leg rhombic or where less horizontal directivity is desired due to a slight spread in the station directions; (3) a long-leg rhombic for use on the high band for maximum gain and directivity; and (4) a short-leg rhombic for use on the high band when less directivity is desired or when it is desired to hang the array from a single pole and two cross arms, or from two poles and a spreader. The latter array is small enough to be mounted on an amateur beam antenna rotator.

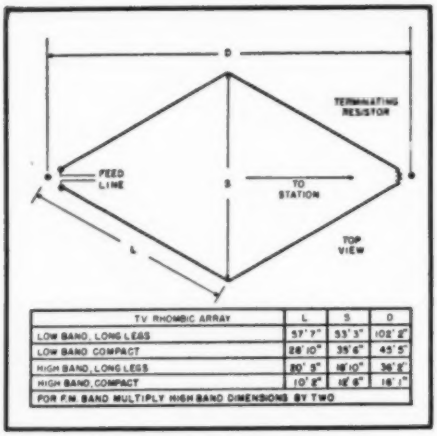
The long-leg rhombics are four wavelengths on a side at their "design center" frequency, have a gain of approximately 10 db.* over a *matched* half-wave dipole (varying slightly over the band), have a useful beam width or acceptance angle of approximately 8 degrees (varying slightly over the band), and exhibit excellent ghost rejection (azimuthal discrimination) throughout their frequency range.

The short-leg rhombics are two wavelengths on a side at their "design center" frequency, have a gain of approximately 7 db.* over a *matched* half-wave dipole (varying slightly over the band), have a useful beam width or acceptance angle of approximately 13 degrees (varying slightly over the band), and exhibit good ghost rejection (azimuthal discrimination)

FOR FM

For an excellent DX FM receiving antenna, simply double the dimensions given in Fig. 1 (Page 62) for the high TV band.

* When comparing gain figures, keep in mind that the high gains claimed by some antenna manufacturers in their advertising are highly "optimistic." A very elaborate dipole array is required for a gain of more than 10 db. over a single matched dipole, and the gain of such an array falls off at a comparatively rapid rate for departures from the design frequency.



TV RHOMBIC ARRAY	L	S	D
LOW BAND, LONG LEGS	57' 7"	53' 3"	102' 8"
LOW BAND, COMPACT	28' 10"	35' 6"	45' 5"
HIGH BAND, LONG LEGS	30' 3"	18' 10"	36' 6"
HIGH BAND, COMPACT	10' 8"	12' 6"	16' 1"
FOR F.M. BAND MULTIPLY HIGH BAND DIMENSIONS BY TWO			

Fig. 1. Design characteristics.

throughout their frequency range.

The low-band arrays employ 68 mc. as a design center, and the high band arrays employ 194 mc. as a design center.

Antenna Patterns and Ghost Rejection

As a measure of vulnerability to ghosts, the common figure of merit for ordinary dipole arrays having a wide acceptance angle is the "front-to-back ratio" on each of the channels under consideration. For an array having an acceptance angle of only a few degrees, however, we are interested in the relative response in *all directions outside the main lobe*, regardless of whether it is off the back or *off the front*. For this reason, "azimuthal discrimination" is a more appropriate term than "front-to-back ratio" when referring to a rhombic array.

Like almost all large, high-gain arrays, a rhombic array exhibits various "minor lobes," and it is the ratio of the amplitude of the main lobe to that of the various minor lobes that determines vulnerability to ghosts. (See Fig. 4.) Generally speaking, as the legs of a rhombic are increased in length and the included angles are maintained at optimum values, the minor lobes become more numerous, sharper, and lower in amplitude (compared to the amplitude of the main lobe).

Strictly speaking the response of a large rhombic to a signal whose modulation envelope changes very rapidly with time, such as a television video signal, is not quite the same as for a steady carrier or a signal containing only low modulating frequencies. The effect is insignificant for a wave arriving "head on," because a wave propagated from the fore end to the aft end of the rhombic via the wires travels not more than about one wavelength farther than the direct distance between these two points, and even on Channel 2 this difference is only about 18 feet.

For television signals arriving obliquely or from the back the effect is no longer insignificant, particularly in the case of a long-leg rhombic cut for the low band. However, the effective azimuthal discrimination will compare closely to that which obtains under unmodulated conditions and, for practical purposes, may be considered to be the same as for an unmodulated signal. It should be pointed out, however, that if an attempt is made with a low-band, long-leg rhombic to receive a nearby TV station off the back side, the picture quality will be poor even though the received signal (due to the transmitter proximity) is of good strength.

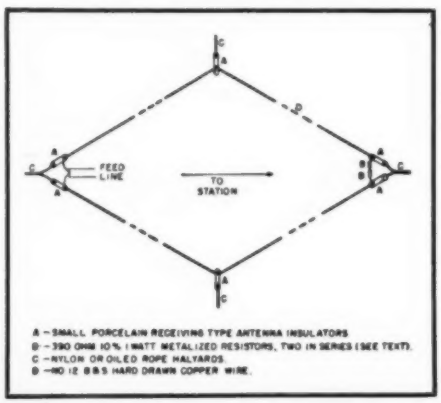
If a rhombic array is placed well above surrounding objects it is not necessary to "probe" the available area for an optimum location. This is explained by the sharp directivity pattern (making the array rather insensitive to phasing reflections from nearby surrounding objects) and by the fact that the rhombic is spread over a considerable area as measured in terms of wavelength.

While the exact location of the array is not critical, so long as it is "in the clear," the direction in which the array is to be pointed must be determined very precisely, particularly for the long-leg jobs. It is for this reason that dimensions for still longer legs are not given in Fig. 1. While even greater gains may be obtained, the beam width becomes embarrassingly narrow, making the array difficult to orient. However, if you are sure you can get the array "dead on" and want to pick up another 2 db., here are the dimensions for legs six wavelengths long at the "design center" frequencies: Low band—L, 86′ 5″; S, 64′ 7″; D, 160′ 2″. High band—L, 30′ 7″; S, 22′ 11″; D, 56′ 8″.

Flat Terrain Installations

If the antenna is to be located in open, flat, or rolling country, and the angular elevation of the horizon is practically zero, then the orientation is fairly simple, and the height of the array is not especially critical (though as much height as practicable is desirable). The array should be pointed in the exact direction of the transmitter. This can be determined by means of a suitable map and an accurate compass. (Obtain the magnetic declination for your area from a surveyor, if this is not already known.)

Fig. 2. Construction details.


FEED LINE
TO STATION
A – SMALL PORCELAIN RECEIVING TYPE ANTENNA INSULATORS.
B – 390 OHM 10% 1 WATT METALIZED RESISTORS, TWO IN SERIES (SEE TEXT).
C – NYLON OR OILED ROPE HALYARDS.
D – #10 12 B&S HARD DRAWN COPPER WIRE.

If the transmitter is on a peak which can be located with a pair of glasses or a telescope, the problem of orientation is still simpler. The orientation of the short-leg rhombics of Fig. 1 should not be off more than about three degrees and that of the long-leg rhombics of Fig. 1 more than about two degrees if maximum performance is to be obtained.

In open, flat, or rolling country, the higher the array the better (within the range of practical pole heights), but there is not much profit in going above about thirty feet for the high-band rhombics or more than about sixty feet for the low-band rhombics unless it is necessary in order to get the array well in the clear with regard to surrounding objects, particularly objects in front of the antenna. The law of diminishing returns applies, and it is up to the individual how much pole expense is justified. The higher the antenna the better, but the higher the antenna the less difference another ten foot length makes, and the harder it becomes to obtain another 10 feet.

Shadowed Locations

When the receiving location is in comparatively flat country but is separated from the transmitter by a range of mountains or high hills some distance away, in such a manner that the angular elevation of the horizon in the transmitter direction is more than about three degrees on the high band or more than about ten degrees on the low band, then one must be careful not to get *too much* height. Under such conditions the height at which maximum signal strength occurs (and above which it falls off) will come within the range of practical pole heights, and high poles may provide too much height.

If the angular elevation of the horizon exceeds the above limits, it is a good idea to lower the array on the poles a few feet to see if the signal strength drops off. If it increases instead, then the array should be run up and down the poles to find the optimum height.

When the angular elevation of the horizon in the direction of the transmitter exceeds approximately eight degrees for a long-leg rhombic or approximately twelve degrees for a short-leg rhombic, it also is a good idea to try elongating the array by increasing the dimension D of Fig. 1 a certain small percentage while checking signal strength, dimension S being decreased accordingly to allow for the elongation. (Elongation raises the elevation angle of the main lobe.) In installations where the angular elevation of the horizon exceeds the aforementioned limits, the distance between the fore and aft poles should be made about fifteen or twenty percent greater than the distance D given in Fig. 1, to allow for experimental elongation of the array.

When sufficient room to permit experimental elongation of the array is

not available, the array should be tipped upwards so that an extended line through the fore and aft apices of the array would intersect the horizon. This requires that the front pole be *higher* than the center poles and that the rear pole be *lower* than the center poles (assuming level ground). The array must be kept in a flat plane, even though it is tipped upwards.

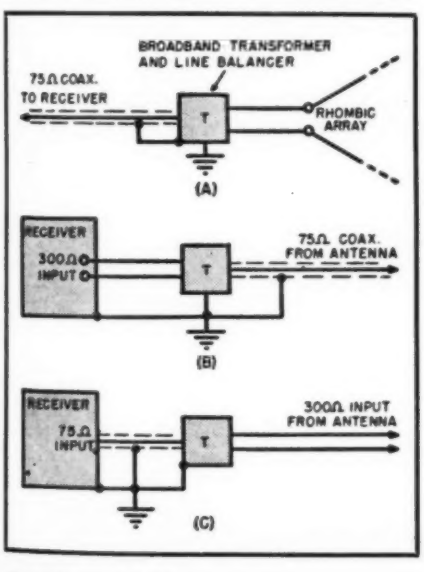
Because of the sharp vertical directivity of the array, one of these two expedients is required for maximum performance whenever the angular elevation of the horizon exceeds the aforementioned limits. The dimensions given in Fig. 1 are for maximum response at zero elevation with the array lying in a horizontal plane. Therefore, for good response at an angle much above zero, the array must be either elongated or tipped upwards. Elongation gives slightly better results and is the preferred arrangement.

Hilly Country

When the array is to be located in hilly country or down in a canyon, it is not safe to orient the array in azimuth simply by aiming it at the transmitter. The dominant signal may be taking a devious route. The safest procedure under these circumstances is as follows.

Using four low, temporary poles and some willing assistants, determine from which compass direction the main signal is arriving. During this operation keep the S and D dimensions nailed down by tying strong string between opposite apices. After the signal direction is determined, lay out the location of the permanent poles,

Fig. 3. Three applications of a broadband impedance transformer and line balancer (T) in conjunction with a rhombic antenna installation. The device is used at the antenna end (A) to permit use of a coaxial line in locations where the line must run through a region of high ambient noise. It is employed at the set end (B) to match coaxial line to a receiver having only 300-ohm input. At (C) it is used at the set end to match 300-ohm ribbon or an open-wire line to a receiver having only 70- to 75-ohm input.



allowing for experimental elongation of the D dimension if there is room. Then proceed as before, checking to see if greater signal strength can be obtained by lowering the antenna. If so, optimize the height and then try either elongating the array in the D dimension or tipping the front of the array upwards, as previously described. This may sound as though a lot of trouble were being taken, but it is necessary in a hilly receiving location in order to insure maximum performance. By following this procedure good pictures have been received in what were considered "impossible" locations.

Occasionally when the terrain is very hilly and the spurious reflections very bad, the discrimination of a rhombic is not sufficient to eliminate a ghost coming in on a minor lobe. If this is the case, try varying the D dimension slightly either way (at the expense of the S dimension). The numerous nulls can be steered over a narrow arc in this manner, and usually one can be lined up on the troublesome ghost without affecting the main signal.

The Terminating Resistor

For proper operation a rhombic array must be terminated in a substantially non-reactive resistance of approximately 800 ohms. Satisfactory operation will be obtained simply by connecting in series two 390 ohm metalized resistors of the insulated, hermetically sealed type (such as an *IRC* type BTA), shown in Fig. 2. Two in series are preferable to a single resistor having twice the resistance, for reasons which need not be discussed here.

Care should be taken to make sure that the resistors used are not of the wirewound type. In the low resistance range, 1 watt resistors are available in both metalized and wirewound types, and the two cannot be told apart by inspection except by type number. If in doubt, break one open to see.

The Feed Line

Only about 10 per-cent loss in signal voltage will result if a rhombic array is fed directly into a 300 ohm line without benefit of a matching transformer. Therefore, while it is possible to construct a matching arrangement which will result in a precise match, the improvement hardly can be considered worth the trouble.

If the feed line must pass through a region of high ambient noise, and it is desired to employ 75 ohm coax for lead-in, it can be done with the aid of one or two of the broadband 300/75 ohm balanced-to-unbalanced transformers now on the market (as manufactured by *The Workshop Associates* and the *J. W. Miller Mfg. Co.*) A transformer is connected between the line and the array as shown at Fig. 3A. The device should be made watertight or protected from the weather. If the receiver does not have provision

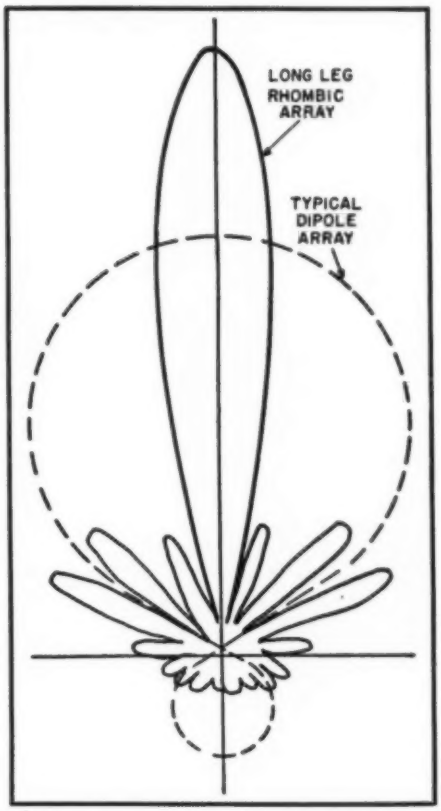


Fig. 4. Horizontal directivity and gain pattern (voltage across 300 ohms) of a typical long-leg rhombic array and of a typical stacked dipole array using parasitic reflectors cut to the channel. The rhombic will maintain substantially the same gain and discrimination over considerable frequency range. The dipole array will not.

for 75 ohm input, another transformer should be employed at the set end of the line, as shown at Fig. 3B.

At Fig. 3C is shown how 300 ohm ribbon or an open wire line may be employed with a set having only 75 ohm unbalanced input (such as certain receivers employing the *Du Mont* "Inputuner").

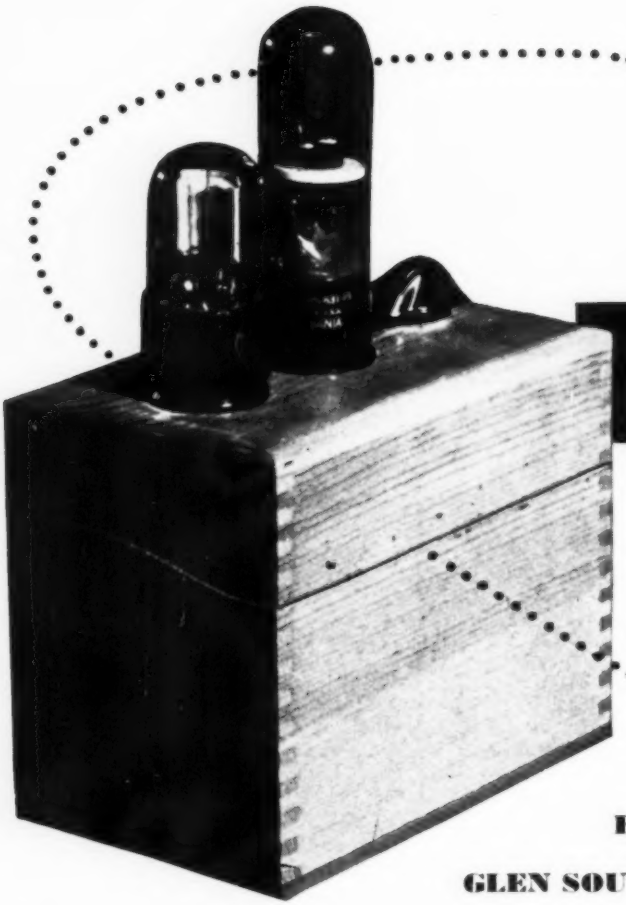
Using Open Wire Line for Lower Losses

Where difficulty is experienced with 300 ohm ribbon close to the ocean becoming very lossy after a few weeks, or where it is necessary to run 1000 feet or more of line to put the antenna in the clear (as in some mountain locations), line losses can be reduced greatly by substituting an ordinary open wire line constructed of No. 14 or No. 12 copper wire spaced two inches. Suitable line spacers are available at radio parts stores.

This type of line is particularly recommended for use on the low band but is still useful on the high band. Somewhat closer spacing is desirable on the high band, but suitable spreaders are not readily available and must be made up. It is best to stagger the distance between spreaders a little, to make sure that all or several do not fall upon exact multiples of the electrical half-wavelength on a desired

(*Continued on page* 102)

A Wireless Extension FLASH UNIT



An ordinary file box is used to mount all components of this flash unit. Phone jack for flashbulb and reflector is mounted on the rear of this box.

By

GLEN SOUTHWORTH

Requires no relays or moving parts and can be used with any flashbulb up to size 50. It will operate up to 300 feet on direct flash with a small portable speed flash as the light source.

THE field of electronics has contributed countless useful devices to other branches of industry. It is the purpose of this article to describe a contribution to the field of photography as the latest of a series of useful electronic devices, such as the light meter, electronic timer, and speed flash.

One of the commonest problems encountered in photography is that of adequate lighting. Use of a flash attachment is a very common method of overcoming the handicap of low light levels. Unfortunately, when pictures are taken by means of a single concentrated light source, unpleasing results may be obtained. To reduce the effect of the harsh shadows often produced by use of a single light source, many photographers use a "fill-in" flash placed off to the side of the subject. Conventionally, a direct connection is made between the camera and the remote flash attachment. This system suffers from the disadvantage of stringing long lengths of wire, in some instances, with the attendant possibility of tripping over the connecting wire and damaging the equipment as a result. Other special conditions may arise, such as taking outdoor shots at night, where several widely-spaced extension flashes may be required, and the difficulty of stringing long lines especially across streets or sidewalks is excessive.

An interesting solution to the problem of the extension flash is through use of electromagnetic radiation as the connecting medium between the camera and the remote flash unit. While radio waves may be used, the transmitter power required is usually such that a license is required. A simpler and more practical arrangement is to use the light output from the camera flash attachment to actuate the remote unit. In this case, the light from the first flash falls on a photoelectric cell and causes the associated equipment to fire the second flash.

A compact, sensitive photoelectric unit capable of firing conventional flashbulbs up to size 50 is shown in the illustrations. The heart of this unit is a special gas-filled tube known as the 631-P1, SN4, or 1D21. This tube is specially designed for relay or stroboscopic work and has the unique ability of being able to conduct instantaneous currents of up to 250 amperes. This feature makes it possible to fire a flashbulb directly without need for a relay. In addition, a very high degree of sensitivity may be obtained, so that a few volts output from the phototube is sufficient to trigger the 1D21.

As the average light levels are often constantly varying, it is usually impractical to connect the phototube directly to the trigger tube. Instead, the two tubes are coupled by a small condenser which allows only the voltage produced by a sudden change of light intensity to reach the grid of the 1D21. The size of this condenser will vary according to the operation desired. The .002 μfd. value shown in the schematic should be sufficient to render the device insensitive to an increase in light intensity, such as turning on a light bulb, but may fire the trigger tube when an object passes between the phototube and a constant light source. If a speed flash is used as a light source for triggering, the coupling condenser may be considerably reduced in size to a point where the sensitivity to the conventional, slow-speed flash is considerably reduced. A capacity of 100 μμfd. or less should operate satisfactorily with a speed flash unit. It should be noted, however, that although a value smaller than .002 μfd. may be used with a conventional flash, this one facilitates easy checking of the operation of the equipment simply by the waving of a small flashlight in front of the phototube.

Sensitivity of the unit will depend upon several factors: The peak light output of the initiating flash, phototube sensitivity in microamperes per lumen, phototube load resistance, and the voltage on the grids of the 1D21. In practice, the circuit may be adjusted so that an increase in light intensity of several lumens is sufficient to start the discharge. This high degree of sensitivity is desirable, as for indoor work it is usually not necessary for the direct light from the first flash to fall on the phototube. This means that the extension unit may be placed in nearly any position where reflected light from the first flash will reach the phototube. On direct flash, using a light source such as a small portable speedflash,

operation may be secured up to three hundred feet.

One of the chief difficulties encountered with this type of remote flash system is in obtaining synchronism between the two flash bulbs. This is due to the inherent characteristics of the flashbulbs themselves. Although the action of the relay circuit is almost instantaneous, the thermal inertia of the medium speed flash bulb is such that the second flash will occur from ten to twenty milliseconds after the first. As a result, to secure full benefit from both flashes it is necessary to shoot at shutter speeds of less than one fiftieth of a second, although this should not be too much of a handicap in many applications. SM-type flashbulbs may be used to achieve some increase in speed, and where the light output of the extension is of primary interest, a speedflash may be used as the tripping source with the camera synchronizer set for conventional flash bulbs. Use of two speed lights greatly reduces the sync problem as the delay is negligible, and in sports photography or other applications where a number of pictures are desired, the multiple flash characteristic of the speed flash means that the extension unit may be placed in the desired location and left without further attention.

As the 1D21 trigger tube used in the extension flash unit is not commonly utilized, the constructor may benefit from a description of its operation. The 1D21 is a gas-filled tube with cathode, anode, and two separate grids, either of which may be used for control purposes. The tube is fired by starting a glow discharge between the grids. This ionizes the tube and causes the tube resistance to drop to a very low level, approximately one tenth ohm. With the inner grid at cathode potential, approximately 115 volts is required to fire the tube. Most of this voltage may be applied to the control grid through a high resistance with the result that only a slight additional voltage, as supplied by the phototube, is required to operate the circuit.

As with most sensitive electronic circuits, instability is a factor to be guarded against. This may result in a lack of sensitivity or, at the other extreme, spontaneous operation. Sensitivity may be greatly reduced when the phototube is exposed to high average light levels with resultant saturation. If the voltage applied to the photocell is too high, ionization of the cell may occur; and relaxation oscillations will trigger the 1D21. Similarly, the bias voltage on the SN4 grids may be too high and continuous low-frequency oscillations result. In the circuit shown, the appropriate voltage drop across the high-value grid resistors is obtained by making use of the "keep alive" current drawn by the grids. If higher voltages are used it may be necessary to use a conventional voltage divider system. A .1 μfd. condenser is placed between the other grid and "B minus" to prevent degeneration and to prevent the voltage on this grid from reaching maximum value as fast as the other grid, reducing any tendency toward continued oscillation.

Referring to the circuit diagram, it will be noticed that a three-position switch is included. The positions are "Off," "Test," in which the flashbulb is shorted and operation may be checked to see if the 1D21 fires satisfactorily, and "Operate," in which the flashbulb is connected in series with the 30 μfd. condenser. The unit should not be tripped without a flashbulb when the switch is on "Operate" or a continuous arc discharge will result with resultant severe drain on the batteries. Similarly, the 10,000 ohm resistor in series with the batteries should not be omitted or a virtual short circuit will occur when the tube is fired.

This unit may be used to fire a speedflash by substituting the primary of the speedflash ignition coil for the conventional flashbulb. In this case it is usually desirable to reduce the value of the series condenser to keep from overloading the ignition coil.

The entire unit may be easily constructed in a small wooden file box with outside dimensions of 5½"x5"x 3½". Holes for the sockets are cut in the lid, and the sockets may then be glued in place. Wiring is simple and may be placed entirely in the lid of the box, giving ready access to all components. The two miniature 67½ volt batteries are housed inside of the box and leave just enough room for the two tubes to be stored when the equipment is not in use. A phone jack is brought out of one side of the lid, and the flash reflector is plugged in here.

The average current drain of the batteries is approximately six tenths of a milliampere, although a much higher instantaneous value occurs during the charge-discharge cycle. The low standby current requirements make it practical to have the device in operation for extended periods of time.

Although this unit was designed especially for use in flash photography, its special characteristics suggest a number of other applications, such as remote control of other devices, as a sensitive, self-contained, photoelectric relay system, or as a self-contained stroboscopic unit.

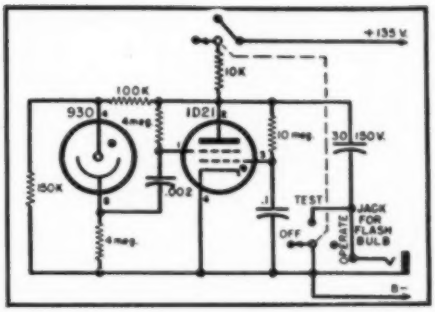


Diagram of remote flash unit; this may be used with a speed flash by reducing size of plate condenser and substituting primary of speed flash ignition coil for the flashbulb. All resistors are ½ watt.

In remote-control or relay service it should be noted that the condenser from plate to ground of the 1D21 makes the tube self-quenching, and if this is removed a continuous arc discharge will result upon application of a single positive pulse to the tube grid. In this case, sufficient resistance should be placed in series with the battery to limit the current to five or ten milliamperes. For photoelectric applications, the blocking condenser between the phototube and the 1D21 grid may be removed to cause the circuit to fire intermittently once the average light level exceeds a predetermined value, or the blocking condenser may be increased in capacity to make the circuit sensitive to slowly-moving objects. Other applications will doubtless suggest themselves to the experimenter.

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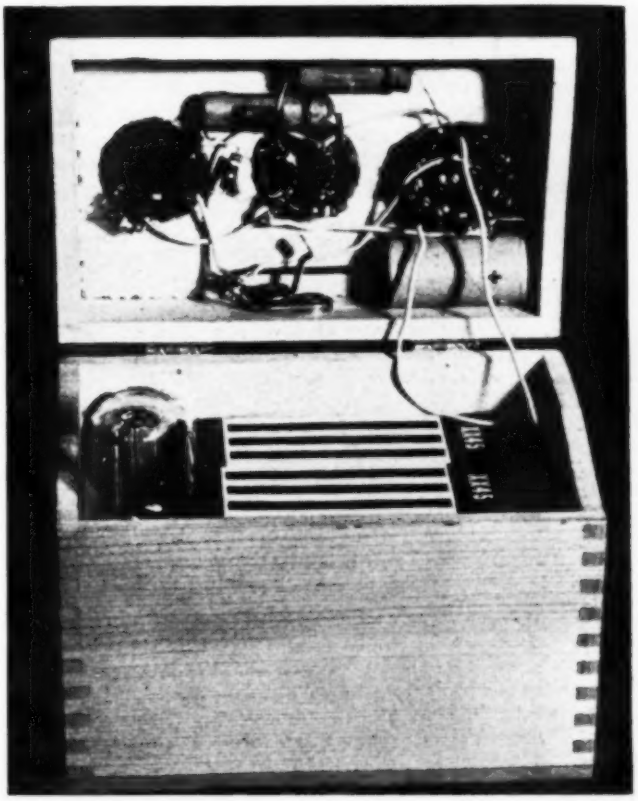
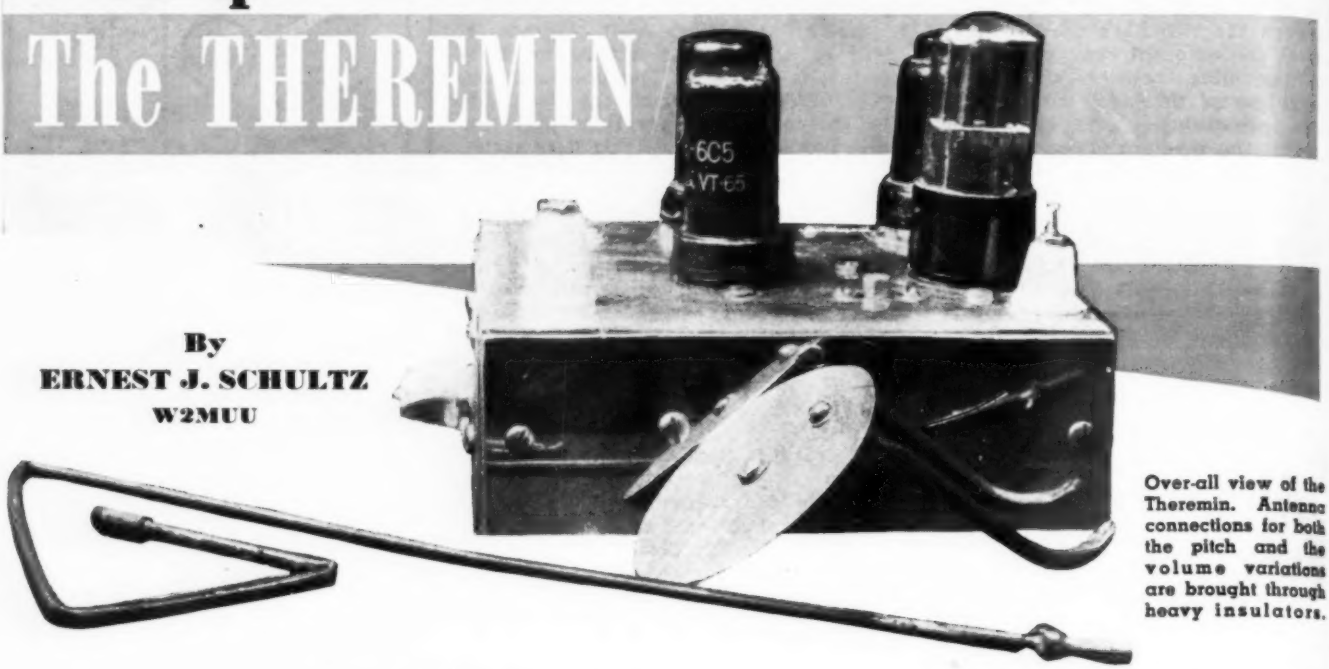
All wiring is housed in lid of box. Two 67½ v. batteries fit conveniently in the lower portion. The two tubes, when not used, also fit within the box to prevent breakage.



A Simple Electronic Musical Instrument

The THEREMIN

By
ERNEST J. SCHULTZ
W2MUU



Over-all view of the Theremin. Antenna connections for both the pitch and the volume variations are brought through heavy insulators.

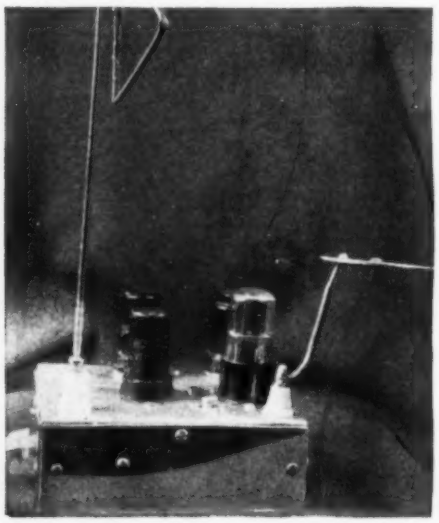
Both hands are used—one to vary the frequency and the other, the volume.

MUSIC produced by the electronic musical instrument known as the Theremin has recently become quite popular. According to the encyclopedia, the name is derived from that of the inventor, a Russian. Sounds produced by the instrument are hard to describe. To say that the device can mimic many instruments and even approximate the sound of a choir would not be inaccurate. In the past few years several widely-circulated movie productions with psychological plots used the Theremin to furnish the background music with eerie trilling effects. Repeated radio performances of the movie recordings have further popularized the music.

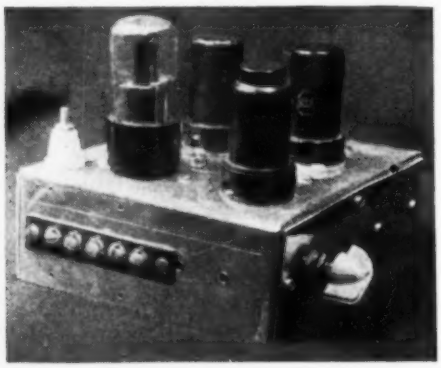
While capable of beautiful effects when in the hands of an experienced player, the instrument emits horrifying wails and ear-piercing shrieks when first approached by a novice. For those experimenters interested in breaking leases or becoming musicians, the Theremin is a "natural" when backed up by a good sound system capable of delivering several watts output.

Overlooking the shrieky side of the instrument and remembering the sweet music, the writer proceeded to construct the instrument herein described and has been rewarded with, you guessed it, the censure of family and neighbors, plus an earache. Lately, however, after much practice and more patience, the caterwauls and moans have started to resemble actual music, and if not too much pressure is brought to bear by the aforementioned family and neighbors, a "musician" may be made. Seriously, however, there is, of course, no annoyance problem to others if the would-be performer uses a pair of earphones.

The frequency control arm is on the left, and volume control arm is on the right.



Terminal strip on the chassis end connects power supply and audio amplifier.



The Theremin is played with the hands, although no physical contact is made with the instrument. One hand is used to produce the music by holding it at varying distances from an antenna, while the other hand controls volume in a similar fashion. Variance in pitch is created with one hand, by adding capacity to an antenna connected to an r.f. oscillator which has been adjusted to zero beat with a fixed r.f. oscillator. Output from the two oscillators is fed to a mixer which converts the difference frequency to an audible tone. The audio frequency thus produced is fed to an amplifier which acts as an isolator stage and, more important, as a variable gain control.

A third oscillator, specially designed and critically adjusted, has its output rectified and applied to the "gain control" tube. When the other hand approaches the "volume control" antenna, the oscillator output drops, thereby reducing the bias on the "gain control" tube and increasing the audio volume. With the hands withdrawn, the beating oscillators are at zero beat and the "gain control" tube is biased to cut-off. The beating oscillators are very similar in their performances to some audio oscillators in wide use by service technicians for testing purposes, whereas the volume control oscillator circuit closely follows a design familiar to constructors of "capacity operated relay devices."

The Theremin herein described and pictured was built without an integral amplifier or power supply, as a good amplifier capable of delivering the extra plate and filament power was available. Another constructor, however, could include both a power supply and an amplifier, all on the same chassis with no ill effects. As low frequencies are used in all oscillator circuits (well below the broadcast band), the circuit layout is not critical and can be changed to suit individual requirements. Four tubes are used in the instrument, a 6SA7 serves as the fixed oscillator and mixer, and a 6C5 is used for the tone producing oscillator. The gain control tube is a second 6C5, while a 6SN7 is the volume control oscillator and rectifier. The tubes may be substituted with equivalent miniatures if so desired.

The chassis used was home fabricated of 1/32 aluminum and measures 6"x5"x2", but as was previously pointed out the layout is not important, and any size giving the builder sufficient working space is suitable.

Both antenna connections are brought through feed-through insulators. The volume control antenna is a 3" piece of 3/16" tubing provided with a 3" diameter metal disc, and the frequency control antenna is a 16" piece of 3/16" tubing bent at the top in a spiral leaving the over-all length about 9". Two controls are provided: one is a manual volume control, and the other is a knob operated trimmer which serves as a manual zero-beat control.

Alignment of the Theremin is as follows:

1. Connect power to the instrument and its output to an amplifier or headphones and allow several minutes for warm-up.

2. Remove 6SN7 tube, turn manual volume control full on.

3. Set manual zero beat control to half capacity.

4. Adjust trimmer condensers on one or both oscillators until audio tone is heard; continue adjustment of trimmer till zero beat is produced.

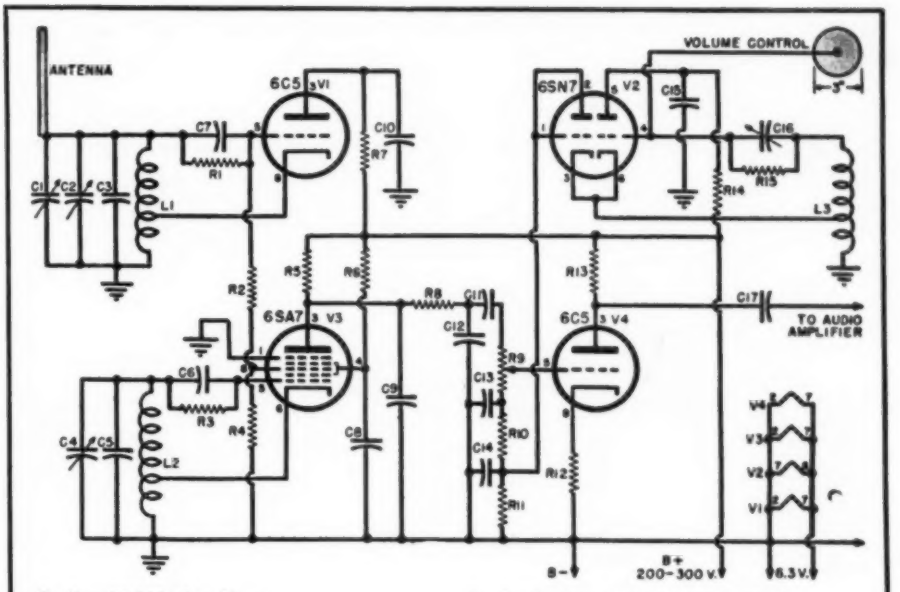
5. Check zero beat with manual zero beat control; audio note should increase in frequency in either direction.

6. Replace 6SN7 tube and allow it to warm up. Hold hand on volume control antenna and adjust manual zero beat control for audible note. Remove hand from volume control antenna.

7. Carefully adjust the air trimmer in the volume control oscillator (using an insulated alignment tool) till the audio note stops. Bring hand *near* the volume control antenna; the tone should increase in intensity as your hand approaches it. Readjust the air trimmer for smoothest volume control action.

8. Readjust manual zero beat control to zero beat.

9. You're in business; control volume with one hand near volume control antenna and pitch with the other hand in a fist near the frequency antenna.



R_1, R_5—*50,000 ohm, ½ w. res.*
R_2—*150,000 ohm, ½ w. res.*
R_4, R_{11}—*100,000 ohm, ½ w. res.*
R_5—*100,000 ohm, 1 w. res.*
R_6, R_7—*1500 ohm, 1 w. res.*
R_8—*20,000 ohm, ½ w. res.*
R_9—*250,000 ohm pot.*
R_{10}, R_{12}—*2000 ohm, ½ w. res.*
R_{13}—*75,000 ohm, ½ w. res.*
R_{14}—*1000 ohm, 1 w. res.*
R_{15}—*4.7 megohm, ½ w. res.*
C_1—*15 μμfd. var. cond. (Zero beat control)*
C_2, C_4—*30 μμfd. trimmer cond.*
C_3, C_5, C_6, C_{12}—*250 μμfd., mica cond.*
C_6, C_7—*100 μμfd. mica cond.*
C_8, C_{10}, C_{16}—*.03 μfd., 400 v. cond.*
C_{11}, C_{17}—*.05 μfd., 400 v. cond.*
C_{13}—*.005 μfd., 400 v. cond.*
C_{14}—*.001 μfd., 400 v. cond.*
C_{15}—*100 μμfd. air trimmer cond.*
L_1, L_2—*130 t. #28 D.S.B. jumble wound on ¾" bakelite rod, 3/8" long, tapped at 30 t.*
L_3—*100 t. #28 D.S.B. jumble wound on ¼" bakelite form, 3/8" long, center tapped.*
V_1, V_3—*6C5 tube*
V_2—*6SN7 tube*
V_3—*6SA7 tube*

Schematic diagram of the Theremin. A separate power supply and amplifier are required.

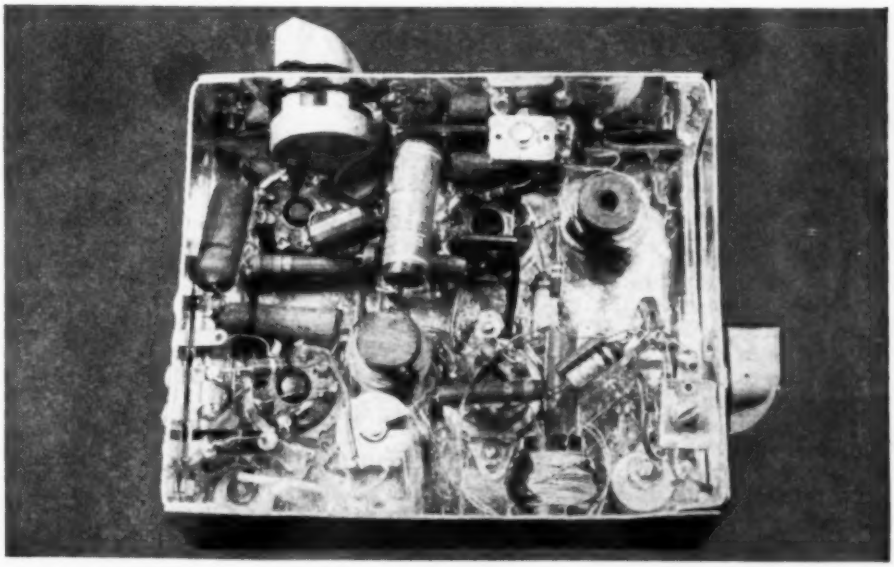
As the output of the device has fairly good waveshape, an amplifier with a tone control is desirable to give some control over the overtones of the music produced. It might even be advantageous to create wholesale distortion of the waveshape by inserting a limiting or clipping device to produce harmonic distortion and thus create the musically desirable rich tones.

The writer believes that this article will be of interest to many experimenters who have heard Theremin music and wanting to build one, have been unable to get constructional data on the device. With practice, almost anyone with an "ear" for music can perform with the instrument.

A suggested method of learning to use the instrument is to accompany phonograph records, such as "In a Monastery Garden," "Lover Come Back to Me," and several other *Victor* records of Theremin and orchestra.

-30-

Under-chassis view: (Top left) 6C5 volume control amplifier; (bottom left) 6SN7 volume control oscillator; (top right) 6SA7 mixer oscillator; (bottom right) 6C5 tone oscillator.



Servicing Intermittents

By ROBERT M. FIELD

Most service technicians get all the information possible about the antics of the set by questioning the owner. A helpful bit of information will save hours of work.

WALK into any radio shop and ask, "How do you go about servicing intermittents?" The chances are you will get an answer like this, "Oh, we just try everything." A hit-or-miss procedure, however, may mean lost time and money for both the technician and the owner.

Good, reliable equipment obviously will help in quickly locating the trouble. A chanalyst or comparable instrument is the best for isolating it to a particular section or stage. Unfortunately, however, for many of the smaller shops, the cost of such instruments is relatively high. If this is the case, a two-stage signal tracer (pentode, first audio, and power pentode output) can be built from "junk box" parts. Distortion may occur when commercial probes with built-in detectors are used in checking audio circuits. To overcome this, use a shielded prod (Fig. 1A) coupled into the signal tracer through a .01 μfd. condenser. A separate prod should be used for r.f.-i.f., utilizing a 100 μμfd. mica condenser to eliminate unwanted audio pickup.

Another important piece of equipment is a v.t.v.m., which can be built from a kit costing no more than an average volt-ohmmeter. The technique used on sets that go dead or lose volume is to connect the v.t.v.m. prod to the a.v.c. circuit at the top of the second detector load resistor. If no change can be noted during the time the trouble occurs, the fault lies in the audio section.

If trouble is suspected in the front end, and you think the oscillator is not functioning properly, put the probe on the oscillator grid; a radical change of grid bias will indicate trouble. For noise, or when you have isolated the trouble with the v.t.v.m., use the signal tracer to pin down the faulty circuit or component.

Noisy tubes, the cause of much intermittent disturbance, are not hard to locate. In most cases, merely tapping the tubes is sufficient, although the defect is not often apparent until they are sufficiently hot. Filaments that open after heating usually cause a slow fade and a slow return to normal set volume.

Shorts, or partial shorts, that occur after the tubes are heated, may cause hum, perhaps when a station is tuned in. The oscillator tube may check "okay" in the tube checker, but a signal tracer may reveal a partial cathode-heater short, which will bring about hum modulation of the receiver oscillator's output.

Low transconductance in the oscillator section of a mixer tube will cause the set to go dead when the line voltage drops, this being especially true in three-way portables. The customer may say that it works all right during the day but that the trouble begins around supper time. Installing a new oscillator tube will not help in many cases.

Using a voltage dropping cord (See Fig. 1B) to lower the voltage to 105 v., parallel the filament dropping resistor in the set with a one or two watt carbon resistor of about 5000 ohms. Decrease the value of this resistor until the filament voltage on the oscillator tube is about 1.2 v. Check to make sure that the filament voltage is not exceeded in normal line voltage and you will have a sure cure for some of those three-way portable intermittents.

Condenser defects can be the most elusive of all trouble-shooting problems. The more ingenious service technicians have worked out a variety of systems to cope with them. Some use a spotlight to open them up with heat, some jiggle them with an insulated prod, and some squeeze them with pliers. Others may just rip them out and put in a new set. Care should be taken not to squeeze a suspected paper condenser, however, as the good ones can easily be spoiled with too much treatment, and the trouble may be multiplied. A bone crochet hook is useful for giving them a gentle push or tug.

With filter condenser hum or noise, it is difficult to tell just what is wrong. In one instance, when an audio signal tracer discovered an increase of hum at the "B plus" terminal, unrolling the condenser disclosed a piece of aluminum clipping that had been left in accidentally during the manufacturing process. Unusual though that example may be, it is included to show that the most minor adjustments may be overlooked in searching for the cause of annoying set troubles. Dust, dirt, or metal filings between the plates of tuning condensers may cause intermittent noise, intermittent operation of the oscillator section and intermittently low volume.

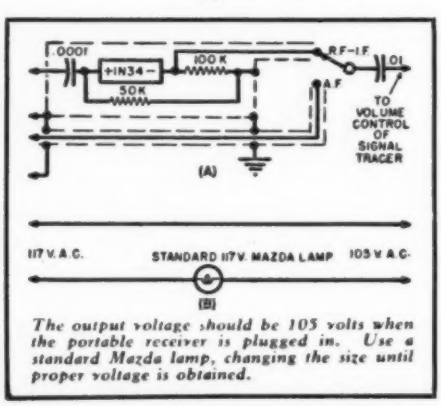
If turning up the volume control causes the set to return to normal, a faulty coupling condenser is a good bet. A loss of volume combined with a tinny sound caused by the weaker bass notes means that it will be necessary to trace down the guilty condenser. An open bypass on the audio volume control bus will cause the i.f. stage to oscillate, and plate supply bypasses can also cause oscillation. Screen supply bypasses can cause both oscillation and lack of volume.

Ceramic type grid condensers may open up from time to time, causing the set to be inoperable at the low end of the broadcast band, coupled with a tuning shift to a higher point on the dial at the high frequency end. This is due to a decrease in capacity across the oscillator coil. Shunting the grid condensers with good ones will point out this difficulty.

Although mica condensers do not usually go wrong, when they do they are especially hard to trouble-shoot. A v.t.v.m. may be used to indicate a

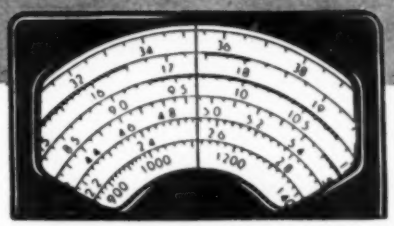
(*Continued on page* 122)

Fig. 1.



The output voltage should be 105 volts when the portable receiver is plugged in. Use a standard Mazda lamp, changing the size until proper voltage is obtained.

International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

THIS month we are pleased to dedicate the *ISW Department* to *Radio Indonesia* in Batavia, Java, N. E. I. Direct from Charles Stuart, English Foreign Broadcasts, *Radio Indonesia*, comes this data on Batavia's new 100 kw. transmitter, which by this time should be testing on 15.15. *Watch for it during the English transmission daily 0600-0700.*

Radio Indonesia's 100 kw. short-wave transmitter, manufactured by *General Electric*, is located at Kebajoran, a suburb of Batavia. The transmitter was ordered during the war but could not be manufactured. It was first intended to erect this station in Dutch New Guinea near Sorong, which was being developed into an oil town by the Netherlands New Guinea Petroleum Company, a concern having sufficient electric power available. This plan fell through, however, and the transmitter has been installed at Kebajoran by the Post and Telegraph Department.

The design of the "K. 100" is modern. It has two panels, each 2.5 meters in length on the left and right of a service door. This door is fitted with a safety switch incorporated into the lock and automatically cuts out the high-tension current if anyone should enter the transmitter's interior. Behind the left-hand panels, which are illuminated by fluorescent lighting, there is the radio frequency installation with protective equipment. The right-hand panels enclose the modulator and sub-modulator, high-tension rectifiers, and the control of the water-cooling system.

The first stage of the radio frequency channel incorporates a crystal with thermostatically-controlled temperature. There are arrangements for ten crystals so that the frequency channel has five different frequencies. An emergency crystal is necessary for each setting.

The second stage incorporates a frequency doubler, while the third acts either in the capacity of a doubler or as an amplifier.

The fourth and fifth stages are amplifiers; the latter is capable of producing eight kilowatt grid driving power for the excitation of the final stage which consists of four water-cooled tubes, 880 in push-pull-parallel. The 100 kilowatt amplifier is tuned by a servomotor which lessens the risk of high tensions.

Modulation of this final stage necessitates that the modulator must deliver 50 kilowatts of audio-power as the Heising-system of modulation is used. The water-cooled tubes are set in "Class B" and are preceded by a four-stage, push-pull sub-modulator, which is quite a normal audio-amplifier.

The main rectifiers produce direct current of 4000 and 10,000 volts. Further rectifiers deliver the grid bias for the larger tubes plus the energy for the smaller amplifiers.

The cooling system of the transmitter uses distilled water for prevention of sediment or scale. The water is in turn cooled by air. Air also is blown via a channel under the air-tight enclosed racks and is extracted via a further channel on top of the racks to the transmitter.

In front of the transmitter there is a control desk for partial remote control of the entire equipment.

The "K.100" has its own power station which incorporates three power units, each with a 270-horsepower *Diesel* motor. Each motor is set on a concrete block weighing 52 tons, and each block is independently sprung to eliminate vibration.

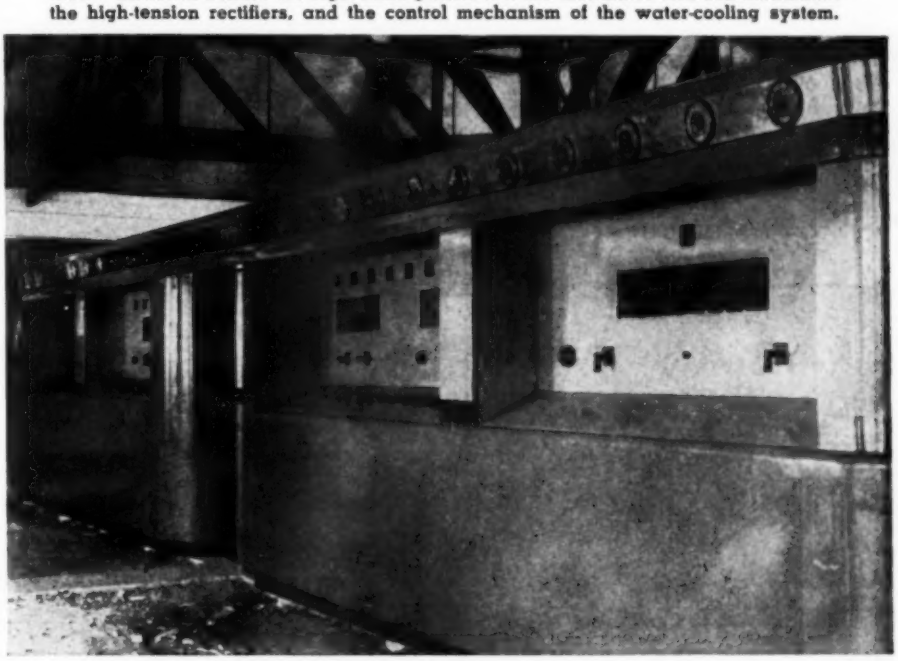
It is definite that the new 100 kilowatt transmitter will be in use long before July 1, 1950, which is the date for the introduction of the proposals of the Mexico City high-frequency conference. It is expected that, temporarily, the same channels will be used for the transmissions which are now in common use by the present low-powered transmitters. The principal frequency will be 15.150, which is the present working frequency of YDC, operating with 3 kilowatts power.

Transmitting power will be radiated by an antenna array of 24 doublets without a reflector. Thereby, a gain is realized by the fact that for Batavia, Australia-New Zealand are in just the opposite direction to India and West-Europe.

Also planned is a rhombic antenna

(*Continued on page* 104)

A front view of the new 100 kw. transmitter of Radio Indonesia, Batavia, Java, N.E.I. Two panels, each 2.5 meters in length, are placed to the left and right of a service door, which is fitted with a safety switch that automatically cuts out the high tension current if someone enters the interior. Behind the left-hand panels, illuminated by fluorescent lighting, is the radio frequency installation with protective equipment. Enclosed behind the right-hand panels are the modulator and sub-modulator, the high-tension rectifiers, and the control mechanism of the water-cooling system.



(Note: Unless otherwise indicated, all time is expressed in American EST: add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.)

A Three-Pound 10-METER BEAM

By

E. F. HARRIS
W9KNK

Construction details of a light-weight, all-metal, two element, ten-meter antenna.

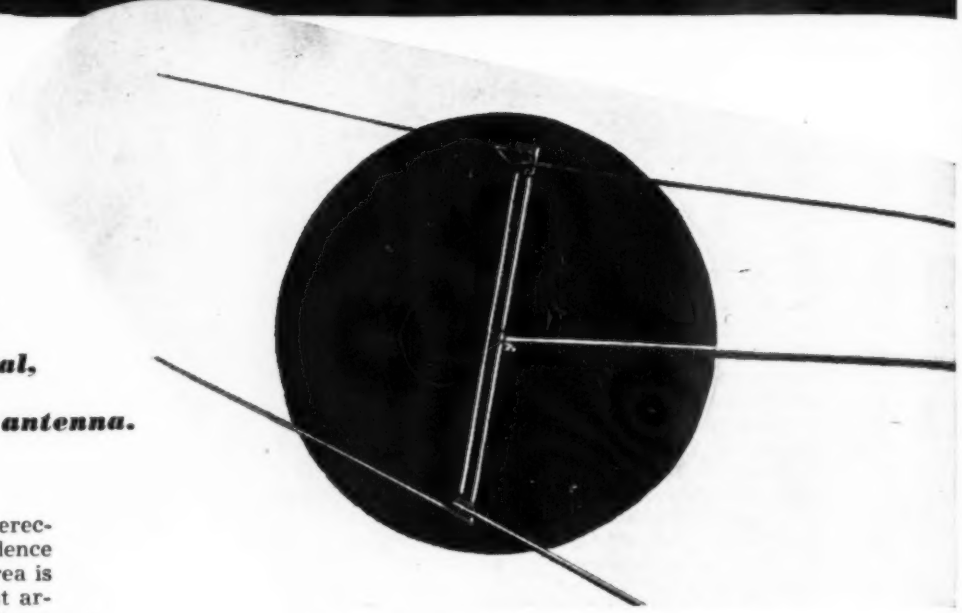


Fig. 1. Close-up view of the all-metal beam antenna.

A GREAT deterrent to the erection of a beam at a residence within a well populated area is the outlandish appearance of most arrays. Some homemade units that are well built give an overbearing appearance, while many of the commercial units when erected give the residence an outstanding, but somewhat unwanted, look. Fortunately, during the past year there has been wide acceptance of the television type array atop houses so that, at present, they no longer evoke a second glance from the average person. The array described was designed to be as inconspicuous as possible, and, in fact, except for the element lengths, it could easily be taken for a television array by anyone unfamiliar with ham radio.

Electrical Considerations

Thumbing through the literature and discussing the problem over the air, it was fairly well established that the average two, three, and four-element beams give results as shown in Table 1 (Fig. 2). The two-element array gives the greatest step in the right direction, in that about 3.5 times power gain is realized. Diminishing returns begin to set in with additional elements, as the three-element array produces 5 times gain and the four-element about 6.5 times. The multi-elements give greater front-to-back ratios; however, considering the overall problem, it was decided to compromise this feature and accept the 10-15 db. produced by the two elements. Incidentally, this amount of rear attenuation is appreciable, and the front-to-side ratio will run about as high as the more complicated arrays, since the number of elements do not affect the direct side pattern to any extent. On receiving, random interference is as likely to arrive from the side as from the rear.

Fig. 2C shows the variation with spacing of an array employing a radiator and a director. Maximum gain occurs at .1 wavelength spacing, but the peak remains high between .1 and .15 wavelength. Investigating Fig. 2D for the variation of radiation resistance with spacing, it is seen that the driven element will present about 15 ohms to the feed system. The final design employs 4 foot spacing, which is .12 wavelengths at 29 mc.

Two feed systems are very popular, and it is desirable to be able to utilize either. Fig. 2A shows the beam fed with 300-ohm twin line. This line is desirable in that it is easily obtainable at a low cost and has very low attenuation. It is more susceptible to effects of rain and weather; however, these may be minimized by proper installation and good matching. A length of 75-ohm transmitting twin line is used to match the 15-ohm array impedance to the 300-ohm line. This transforming section is ¼ wave at 29 mc. and should be cut to 69 inches. The resulting SWR on the 300-ohm line is less than 1.5.

Fig. 2B shows the arrangement for employing coaxial cable. While it is still available on the surplus market at extremely low cost, this feed line is attractive in that it offers ease of installation and good stability with fairly low loss characteristics. RG-8/U has a characteristic impedance of 52 ohms and is recommended for this application. Two quarter wavelengths wired in parallel will present a transforming impedance of 26 ohms. When connected to the 52-ohm line, this arrangement will produce a SWR of less than 1.5. The two lengths of cable should be 67 inches each, and they should be carefully prepared with the inner conductors connected together and the outer shield braids bonded well at both ends. Some means should be taken to weatherproof the ends. The use of coaxial connectors makes for a good installation; however, this method is expensive in that it involves the use of several connectors. An ex-

Fig. 2.

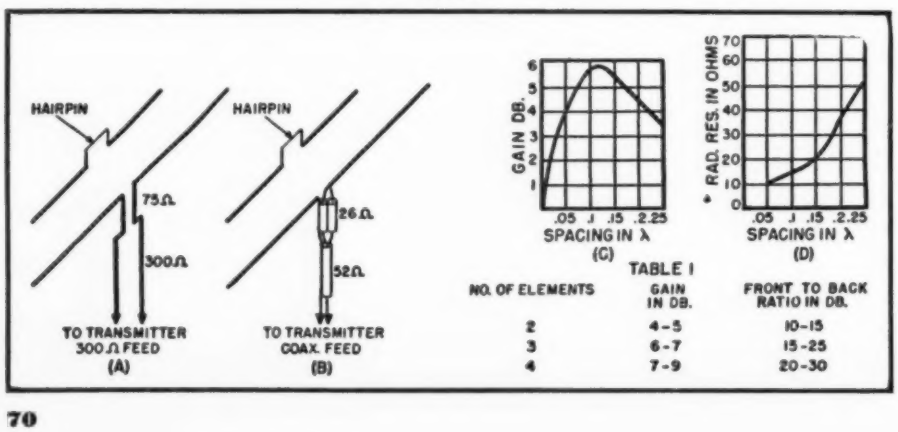


TABLE I

NO. OF ELEMENTS	GAIN IN DB.	FRONT TO BACK RATIO IN DB.
2	4-5	10-15
3	6-7	15-25
4	7-9	20-30

cellent method is to prepare the cables carefully and then use one of the available potting resins to effect a permanent seal.

The director is tuned with a hairpin arrangement at the center of the element. With the spacing as shown, the final length arrived at is 15 feet, 6 inches for the director; the radiator is cut at 16 feet. After the correct length of the parasitic element was determined, a permanent type of hairpin was constructed of ⅛ inch brass rod as shown in the photograph.

Mechanical Design

The choice of materials for the beam is restricted by the light weight requirement; however, there are available aluminum alloys which are capable of handling high stresses while maintaining low weight ratios. The tubing chosen for this unit is 24ST throughout; this aluminum alloy was developed for aircraft work and is the strongest available at the present time. Its yield point is between 60,000 and 70,000 pounds per square inch. A square-shaped tubing was chosen, as this form lends itself readily to ease of fabrication. The elements consist of a half-inch square tube with .025" wall, while the boom is constructed of similar tubing with heavier wall (.064") for added strength. Fig. 4B shows the cross section of the tubing, together with some of the dimensions used in the calculations for conditions of maximum loading the array will stand.

The constructional details are simple and straightforward. Two four-foot lengths of the .064" wall tubing are prepared and attached to the center support bracket. See Figs. 6A and 6C. The center support bracket is constructed from a piece of 2½"x2½"x¼" aluminum angle. The angle is drilled and tapped to accept the screws which hold the boom elements and in addition has a large hole in the top side to clear the 1" mast. A formed strap clamps the bracket tightly in place on the mast.

Two Lucite insulators, 3⅛"x3¾"x¼" thick, are prepared and attached to each end of the boom. The Lucite is strong mechanically and provides good insulation at the fairly low impedance points represented by the centers of the elements. The center of the director is insulated in order to provide for adjustment by means of the hairpin assembly.

Two eight-foot lengths of the .025" wall tubing are prepared for the radiator and two more, 7'4", for the director; the hairpin makes up the necessary additional length for the director. Thus these nine pieces, together with the necessary hardware, go to make up the entire beam.

It is desirable in this sort of design to calculate the stresses which are liable to occur under conditions of heavy winds and ice encountered in many installations. The lightness of such a structure is misleading and may

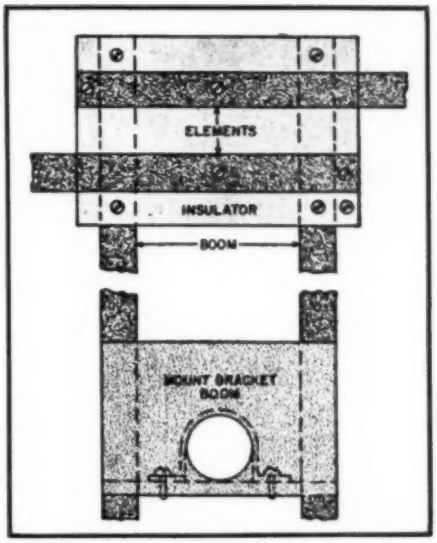


Fig. 3.

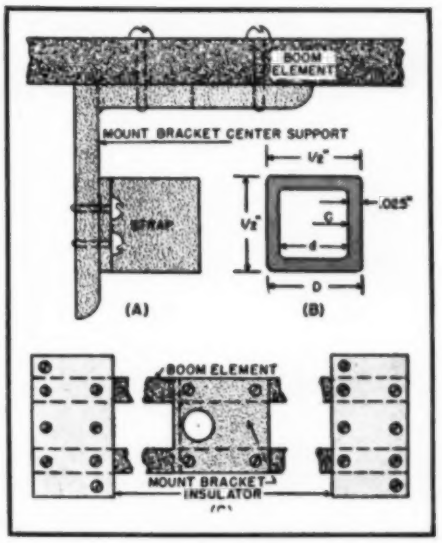


Fig. 4.

give one a tendency to discount it as being weak mechanically; however, it is possible to obtain high strength in light structures as has been proved by the aircraft industry in the past.

In this section of the country, there rarely occur winds of velocity greater than 75 m.p.h. Also, it is safe to predict that a half inch of radial ice is about the maximum amount that will form on the elements. It is also true that the maximum wind velocities do not occur simultaneously with the formation of ice and that about 50 m.p.h. should be the maximum wind velocity with ice. Accordingly, calculations have been run, first, for the condition of no ice and a 75 m.p.h. gale and, second, for ½" radial ice and a 50 m.p.h. wind.

Stress Calculations

Wind pressure = $.0025\ V^2$

Stress = MC/I

Where:

M = maximum moment (in lbs)

C = radius of member

I = moment of inertia = $.05\ (D^4\text{-}d^4)$

For 75 m.p.h. wind and no ice.

$P = .0025(75)^2 = 14.5$ pounds per square foot of area.

The projected area of one element (8') as a cantilever from its support is $.5/12 \times 8 = .333$ square feet.

Total load on member is $14.5 \times .333 = 4.85$ pounds.

The moment occurring at the point of support is the total load acting at half the distance out on the element.

$$M = \frac{4.85 \times 8 \times 12}{2} = 232 \text{ inch pounds}$$

$$\text{Stress} = MC/I = \frac{232 \times .25}{.05\ (.5^4\text{-}.45^4)}$$

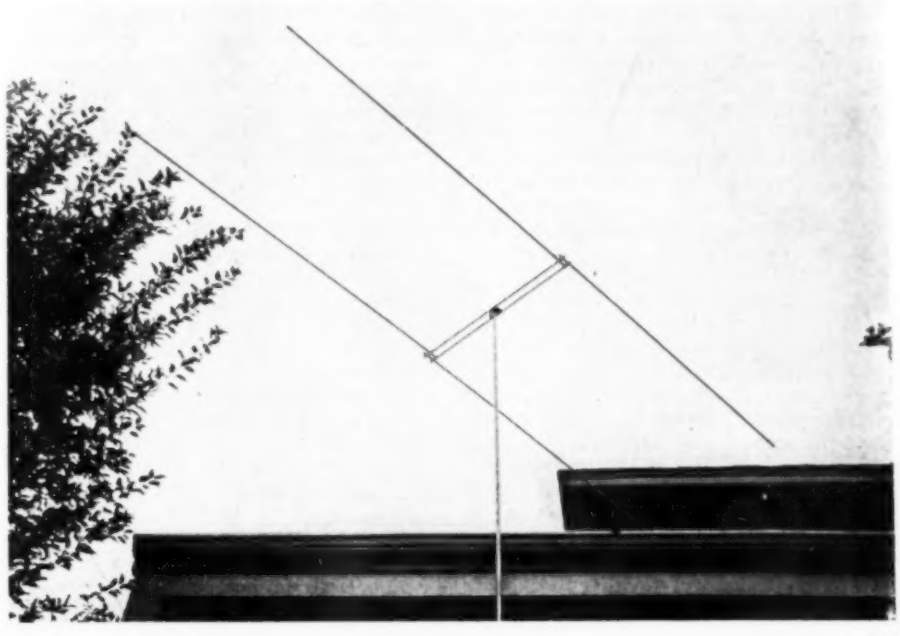
$$= \frac{58}{.05\ (.0625\text{-}.041)} = 58/.00108$$

$$= 54{,}000 \text{ pounds per sq. inch.}$$

Note that the 24ST aluminum tub-

(*Continued on page* 170)

Fig. 5. A two-meter beam, or even a TV array can be mounted on top of this unit.



Audio Service and Development Techniques

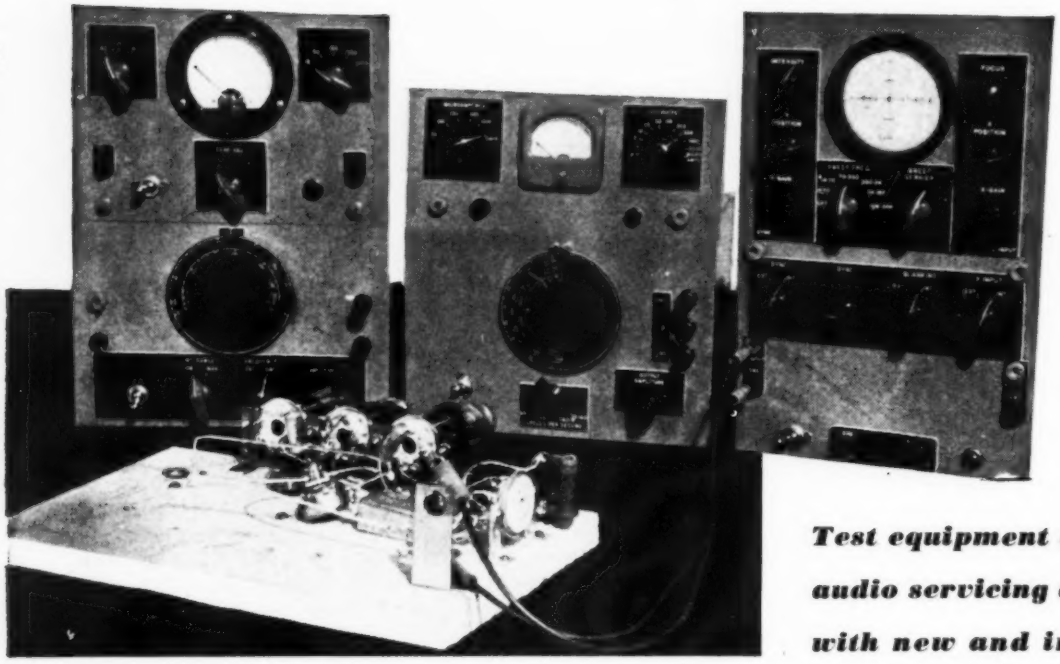


Fig. 1. Author's setup used to check a multivibrator circuit. A breadboard arrangement of this type is very simple to assemble.

Test equipment and techniques for audio servicing and experimenting with new and improved circuits.

By

J. CARLISLE HOADLEY

TO THE service technician who familiarizes himself thoroughly with the many applications and uses of the various test instruments, there will be hardly any problem arising from improper operation of a receiver, from detector to speaker, that cannot be rapidly diagnosed. In this article, we will examine the operation of the oscilloscope, the audio oscillator, the vacuum tube voltmeter, and the square-wave generator. The scope, of course, can be used as a vacuum tube voltmeter, in addition to its other virtues.

First, let's consider how these instruments may be helpful in service work. For clarity, specific cases will be studied while considering the various problems.

On the bench is a receiver suffering from a severe case of distortion. This is easy to locate with the scope. Connect the audio oscillator across the volume control; the *Y* axis input of the scope is clipped across the speaker voice coil. A frequency of 1000 cycles may be chosen, as any audio system should pass it readily. With the oscillator output adjusted to about 1 volt, increase the receiver volume control until a pattern appears on the scope tube.

The next step is to adjust the *Y* axis gain until the picture is approximately one inch high. Set the sweep-frequency control until you have several cycles, and stand it still with the least possible amount of sync. If the waveform departs in shape from the wave from the oscillator, the distortion is in the audio system.

Different types of distortion will make themselves known in different ways. For instance, if a sine wave with a square top is noted, it may be considered that one of the amplifier tubes is being driven either to zero bias or to cut-off. Using the *Y* axis scope lead, start at the oscillator and work toward the output stage, touching the grid and plate, respectively, of each successive tube. Presently, you will come to the offending stage.

By touching the *Y* axis lead to a "B+" point in the amplifier, it can be determined whether the beam is deflected up or down with a positive voltage and, from that, which polarity of the sine wave is distorted.

If the negative peak is observed at a tube plate, for instance, this might indicate a shorted cathode bypass condenser, which would accomplish the same effect of removing the bias on the stage and limiting the ability of the plate to swing negative. If the distortion takes the form of hum, it will show up on the scope screen in the offending stage as a 60 or 120 cycle modulation on the 1000 cycle test signal. The hum might be caused by an open filter condenser, an open cathode bypass condenser, or a tube with a cathode to heater short.

Progressing from stage to stage, the voltage gain of the system can be measured, either with the scope or the vacuum tube voltmeter. Just measure the voltage at the grid of the stage, then the a.c. voltage at the plate; divide the former into the latter, and that is the gain. Reference to a tube manual will indicate if it is in the right order. Phase inverter circuits may be checked also to see if their outputs are equal in amplitude and 180° out-of-phase. The amplitude can be measured with the scope or the vacuum tube voltmeter.

To check the phase inversion, connect the *Y* axis plate to the one output and the *X* axis plate to the other output, switching off the sweep circuit. You should get the familiar circular pattern if the inverter is okay. If frequency distortion is suspected we can run a response curve or give a quick check with the square-wave generator.

For an accurate determination, connect the audio oscillator to the amplifier's input. Remove the speaker from the circuit and substitute a resistor of the proper resistance (usually 6-8 ohms) and of sufficient dissipation (10 or 20 watts). Connect the vacuum tube voltmeter across the oscillator output and the scope *Y* axis input across the output resistor. Starting at a low frequency and holding the oscillator's output constant at a value

low enough not to overload the amplifier, increase the frequency. Note the waveform on the scope screen, and record the amplitude of the voltage across the output resistor at each frequency. Be sure that the amplifier's tone controls are in the normal, or "flat," position.

Afterward, the response curve may be drawn on graph paper. It is conventional to use four or five cycle semi log paper for audio amplifiers. You can plot frequency against response in either volts or decibels. If there is a serious discrepancy in response, it can be corrected by locating the offending part. If it is an inherent characteristic of the amplifier, equalization may be inserted to compensate for it.

We may connect the scope across the output of a phonograph pickup and observe distortion while it is playing an actual selection. Some crystals show no distortion when reproducing a single frequency but do generate considerable distortion in the presence of a complex wave. The pickup response curve may be run by playing a "tone test" frequency record and noting the output voltage on the scope.

The speaker and baffle may be checked for rattles and resonances by connecting the oscillator to the amplifier's input and the speaker to its output and running through the frequency range. The lower frequencies will show up any rattles caused by a misaligned voice coil, cone tears, loose or flimsy cabinet construction, loose hardware, and any microphonic effects.

Power output may also be found by measuring maximum undistorted output voltage across the proper load resistance and computing the power by the formula $P = E^2/R$. Remember that if you use the scope to measure the output voltage, it indicates the peak-to-peak value of the voltage. Power is compiled with the r.m.s. value. The peak-to-peak value is 2.82 times the r.m.s. value. The vacuum tube voltmeter will indicate the r.m.s. value of a sine wave on the a.c. ranges.

Another aspect of these test instruments is their invaluable aid to those who like to develop their own circuits. In these experiments, the instruments constitute a complete audio laboratory.

It is wise to first set up your proposed circuit on a breadboard and have all the possible bugs ironed out before the finished chassis is drilled. This not only saves a lot of grief in the completed unit, but also permits giving some intelligent thought to neat layout and wiring of the proposed equipment.

Fig. 1 shows the author's setup to develop a multivibrator circuit. The wooden breadboard is cheap and it is easy to mount parts on it. The arrangement may be used over and over again.

In developing circuits which require shielding, it is wise to use a metal breadboard which simulates not only the chassis in the finished model, but also all the capacities to ground that the chassis will cause.

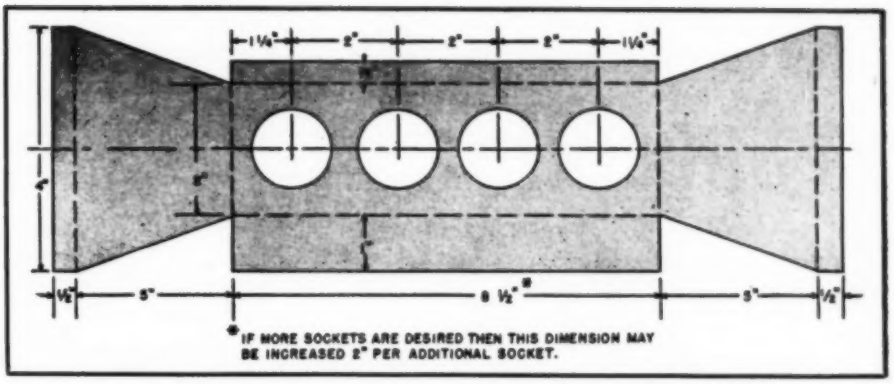


Fig. 2. Metal blanking of a 4 tube development chassis. It is similar to the completed unit shown in Fig. 4, provisions for a power supply being omitted.

Fig. 4 shows a very convenient metal development chassis. The tubes are out of the way, with the socket connections in the most convenient position. A series of holes is drilled in the apron along one edge to facilitate the mounting of pots, coils, condensers, and other circuit elements. This also provides a rugged setup which may be left wired for some time if it is planned to develop a second series of circuits dependent on the first ones.

A binding post strip is mounted on the side so that connection to a power supply may be easily made. This chassis might contain a power supply for greater convenience and flexibility.

The vacuum tube voltmeter can be used as a capacity measuring device by utilizing the a.c. ranges. It is hooked up in the same manner as an ohmmeter, except that a.c. is used instead of a battery. A filament transformer on the 60 cycle output of the scope will do. The audio oscillator set to a medium high frequency can be used to measure small condensers.

The voltage ranges may be calibrated by observing the reading for a series of condensers known to be good. Fig. 3 shows the setup. If you can secure four points on each scale on the vacuum tube voltmeter, you may draw a curve so that you can read any capacity from the curve. The square-wave generator can be used to check the response of an audio amplifier quickly by noting the distortion of the wave on the scope. It is also useful to insert a calibration signal into the *Z* axis input on the scope. This will produce a series of dashes on the trace, which can be used when it is desired to find the frequency of a waveform while it is being observed with the linear sweep circuit. This square wave can be used to blank off some unwanted portion of a waveform under observation, or to brighten a wanted part.

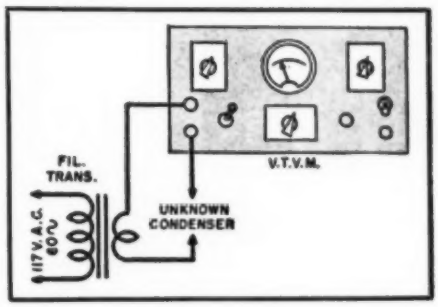


Fig. 3. A capacity measuring setup.

The scope has a multitude of other uses by itself, such as finding why a receiver distorts when all voltage components and tubes check okay. That can happen in, for instance, a receiver with a negative feedback circuit. One of the feedback wires is inadvertently moved too close to the

(*Continued on page* 125)

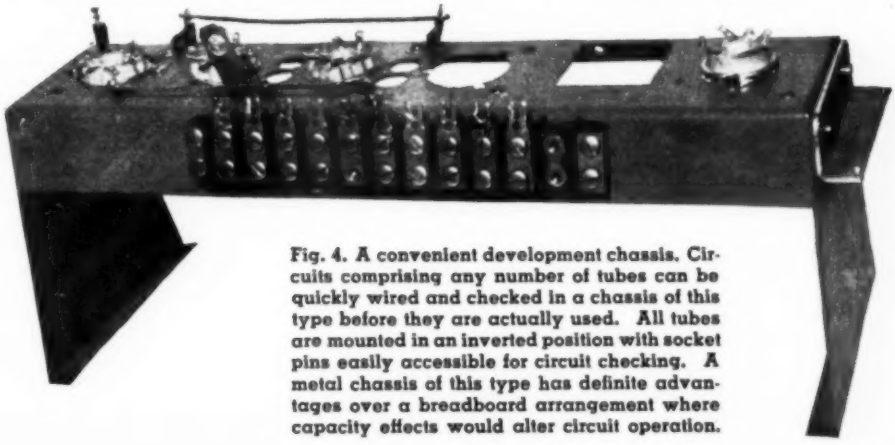


Fig. 4. A convenient development chassis. Circuits comprising any number of tubes can be quickly wired and checked in a chassis of this type before they are actually used. All tubes are mounted in an inverted position with socket pins easily accessible for circuit checking. A metal chassis of this type has definite advantages over a breadboard arrangement where capacity effects would alter circuit operation.

A Special Wide-Band Scope Amplifier

By MILTON KAUFMAN
RCA Institutes

Modernize that oscilloscope — add these features to your present instrument and make it more versatile.

TWO inherent faults which exist in many popularly priced oscilloscopes are the slugggishness of positioning movements in the horizontal and vertical directions and the poor frequency and phase response characteristics over a wide band of frequencies. The circuit presented herewith eliminates these faults by providing instantaneous changes of positioning and wide-band characteristics of both horizontal and vertical amplifiers. Also included in the circuit is a frequency-compensated attenuator.

Frequency Response Requirements

The necessity for wide-band response of the horizontal amplifier may not be immediately apparent when it is remembered that the maximum sweep frequency is usually limited to 50,000 cycles-per-second. However, it is the shape of the saw-tooth wave which requires wide-band response rather than its repetition frequency. In Fig. 1A is shown a saw-tooth wave of 50,000 cycle repetition rate with a retrace of 10 per-cent. The entire period of one wave takes 20 microseconds, and the retrace time is equal to two microseconds. Maximum fundamental frequency of this wave may be computed by

$$F = 1/2T$$

where T equals the retrace time, and thus F equals 250,000 cycles. If the maximum repetition rate of the sweep frequency of 200,000 cycles were used, a bandpass of at least one megacycle would be needed.

At the low frequency end of the spectrum, saw-tooth waves as low as 15 cycles-per-second are of practical use. If the proper waveshape is to be maintained, at least the fifth subharmonic should be passed, or three cycles. Thus it is readily seen that the horizontal amplifier should possess wide-band characteristics. Signals applied to the vertical amplifiers may range in frequency from 0 to several megacycles. For example, to obtain good response on a 100,000 cycle square wave, the amplifier should pass at least the tenth harmonic or more, setting the minimum response at one megacycle. To obtain a flat top on the square wave, the low frequency response should extend flat to the tenth subharmonic which, for a 60-cycle square wave common in television testing, would mean six cycles.

A conventional positioning circuit is shown in Fig. 1B. Whenever the positioning control R_1 is moved, condenser C_1 must charge to the new d.c. potential through R_1. This makes up a long time constant circuit. Thus the spot travels slowly across the screen as the condenser charges or discharges. If this sluggishness is to be eliminated, there must be no condenser level to change, which means that direct coupling to the deflection plates is necessary.

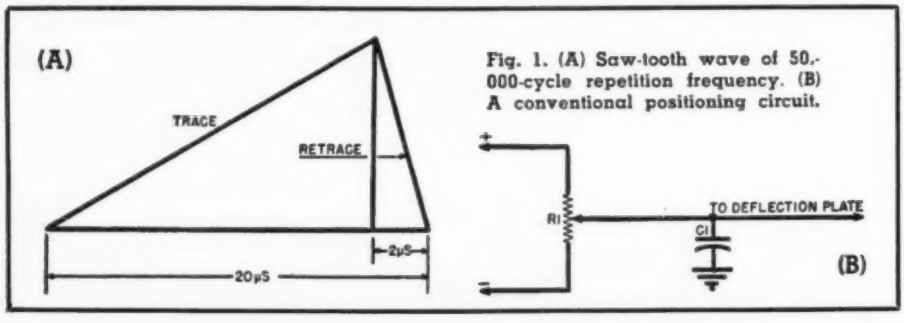


Fig. 1. (A) Saw-tooth wave of 50,000-cycle repetition frequency. (B) A conventional positioning circuit.

Resume of the Circuit

A brief summary of the improved circuit as shown in Fig. 2 is as follows: The input consists of a three-step frequency compensated attenuator, a cathode follower input stage direct coupled to a grounded grid amplifier compensated for high-frequency response. This is direct coupled through a constant impedance network containing the positioning control to a push-pull cathode coupled deflection amplifier which in turn connects directly to one set of deflection plates.

Attenuator

Stray capacities such as C_1 and C_2 in Fig. 5A are negligible at low frequencies but assume increasing importance as the frequency becomes higher. At high frequencies, they will cause reduced input impedance to the scope, which is undesirable if the circuit being tested is not to be disturbed from its normal operation. They will also cause frequency and phase distortion of the observed signal, thus changing its waveshape on the scope from the original. This condition varies with the position of the slider on R. To remedy this situation, use is made of a frequency compensated calibrated step attenuator, a simplified circuit of which is shown in Fig. 5B. If the time constants, R_1C_1 and R_2C_2, are made equal, the ratio of output to input voltage E_2/E_1 will be independent of frequency. Since the value of C_2 is fixed, C_1 may be computed from

$$C_1 = R_2C_2/R_1$$

The sum of R_1 plus R_2 is always kept to approximately two megohms and thus is equal to the input impedance for all settings of the attenuator.

Coupled directly to the attenuator and thus eliminating the need for compensation is the first stage of the amplifier, a cathode follower V_{1a} (Fig. 2). Important advantages of the cathode follower as an input stage are low input capacity to prevent high-frequency attenuation of the signal and high in-

put impedance to prevent loading a circuit under test. For the triode in question the dynamic input capacity in $\mu\mu$fd. is given by

$$C_{in} = \frac{C_{gk}}{1 + G_m R_k} + C_{gp}$$

and equal to 4.93 $\mu\mu$fd. as against about 48 $\mu\mu$fd. when used as a conventional amplifier, with a normal plate load resistor.

$$C_{in} = C_{gk} + C_{gp}\,(1 + A)$$

The signal voltage is developed across the cathode resistor R_9 of V_{1b} (Fig. 2). It will be noticed that the grid of this half of the 6SN7 tube is connected directly to ground. Therefore, any variations of cathode voltage will be applied to the second triode section as input signal. Since this constitutes direct coupling, no low-frequency compensation is necessary. Loss of gain at the high-frequency end is caused by the shunting effect of the output capacitance of V_{1b} plus about five $\mu\mu$fd. additional stray capacitance in the plate circuit. This is compensated for by shunt peaking coil L_1 calculated from

$$L_1 = .5C_tR_7^2$$

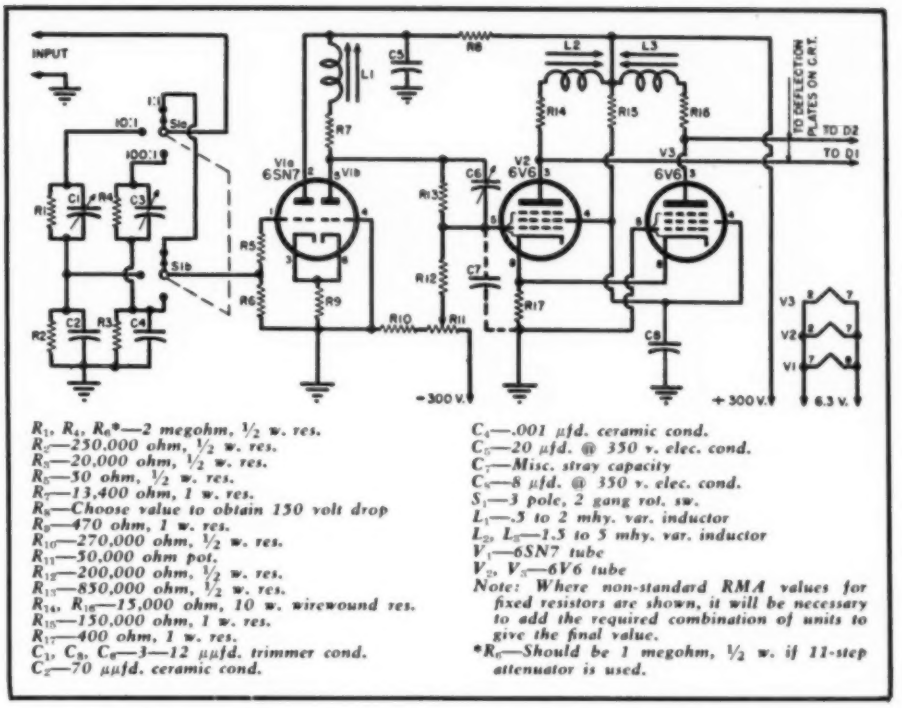
where R_7 equals the plate load resistor and is equal to the reactance of C_t at the compensating frequency of one megacycle.

$C_t = C_{out} + C_{stray} = 7 + 5 = 12$ $\mu\mu$fd.

Thus R_7 equals 13,400 ohms and L_1 equals one millihenry.

Coupling to the push-pull stage is accomplished by the constant impedance network $R_{13}C_6$—$R_{12}C_7$ where C_7 is equal to the input capacitance of V_2 and is an inherent part of the circuit. C_6 is a variable condenser and is adjusted so that the time constant $R_{13}C_6$ equals $R_{12}C_7$. The procedure for adjusting the amplifier will be discussed below. Potentiometer R_{11} acts as the positioning control and the network of resistors R_{10}, R_{11}, R_{12}, R_{13} is chosen so that with the positioning control at the center point, the voltage at the grid of V_2 will be 0 with respect to ground and may be varied seven volts "plus" or "minus." Positioning action which is instantaneous is accomplished as follows: Assuming a change of R_{11} is such as to cause a positive voltage to appear on the grid of V_2, the increased plate current will cause a more negative d.c. potential change at the plate of V_2 and deflection plate D_1 to which it is directly coupled. The increased plate current causes a greater positive voltage to appear at the top of cathode resistor R_{17}. Since the grid of V_3 is grounded, this has the same effect as though a negative voltage were impressed on the V_3 grid, thus reducing the plate current and creating a more positive voltage at the plate of V_3 and deflection plate D_2. The positioning action, therefore, is not only instantaneous but also more effective, since it is operated in push-pull fashion causing opposite polarities of d.c. voltage changes to appear on the pair of deflection plates.

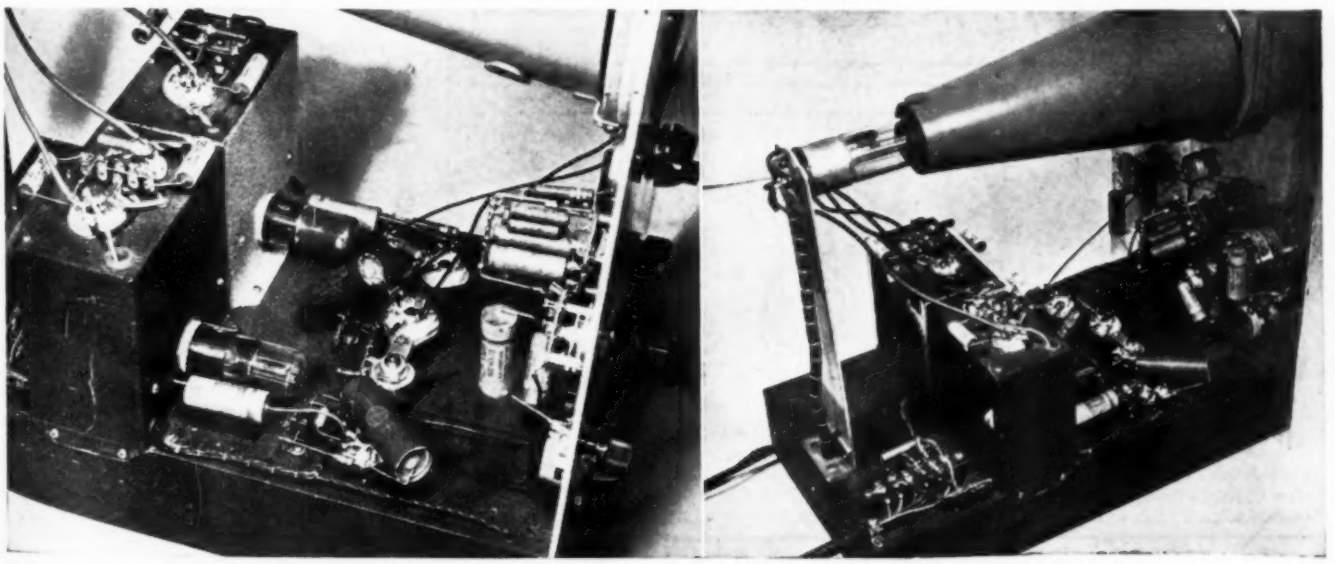
Output amplifiers V_2 and V_3 are direct coupled by cathode resistor R_{17} and are fed from the constant impedance network directly to the grid of V_2. No low-frequency compensation is necessary here, but the loss of gain at high frequencies is taken care of by L_2

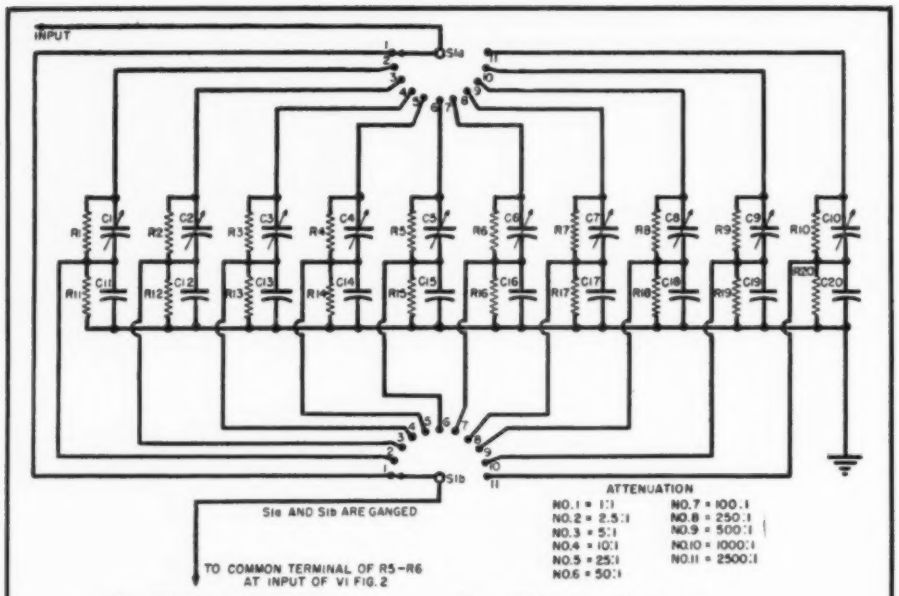


R_1, R_4, R_6*—2 megohm, ½ w. res.
R_2—250,000 ohm, ½ w. res.
R_3—20,000 ohm, ½ w. res.
R_5—30 ohm, ½ w. res.
R_7—13,400 ohm, 1 w. res.
R_8—Choose value to obtain 150 volt drop
R_9—470 ohm, 1 w. res.
R_{10}—270,000 ohm, ½ w. res.
R_{11}—50,000 ohm pot.
R_{12}—200,000 ohm, ½ w. res.
R_{13}—850,000 ohm, ½ w. res.
R_{14}, R_{15}—15,000 ohm, 10 w. wirewound res.
R_{16}—150,000 ohm, 1 w. res.
R_{17}—400 ohm, 1 w. res.
C_1, C_3, C_6—3—12 $\mu\mu$fd. trimmer cond.
C_2—70 $\mu\mu$fd. ceramic cond.
C_4—.001 μfd. ceramic cond.
C_5—20 μfd. @ 350 v. elec. cond.
C_7—Misc. stray capacity
C_8—8 μfd. @ 350 v. elec. cond.
S_1—3 pole, 2 gang rot. sw.
L_1—.5 to 2 mhy. var. inductor
L_2, L_3—1.5 to 5 mhy. var. inductor
V_1—6SN7 tube
V_2, V_3—6V6 tube
Note: Where non-standard RMA values for fixed resistors are shown, it will be necessary to add the required combination of units to give the final value.
*R_6—Should be 1 megohm, ½ w. if 11-step attenuator is used.

Fig. 2. Diagram of the vertical deflection circuit. An identical unit is used for the horizontal sweep circuit. The deflection sensitivity is approximately 21 r.m.s. volts-per-inch at the plates or about .07 r.m.s. volts-per-inch through the amplifier. The frequency response is relatively flat from 0 cycles to about 1 megacycle.

Fig. 3. (Right) Over-all view of the completed scope using a 5BP1 cathode-ray tube. Plate load resistors for the output deflection amplifiers may be seen mounted on top of the two small metal compartments. (Left) The cathode follower and amplifier stage 6SN7 for the vertical and horizontal deflection circuits are shown to the left, front to rear, respectively.





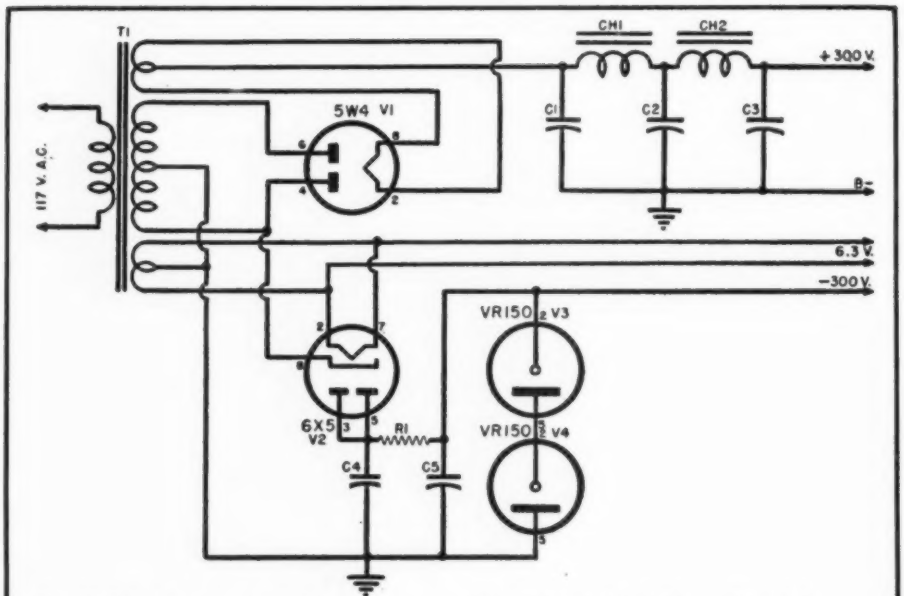
R_1—600,000 ohm, ½ w. res.
R_2—800,000 ohm, ½ w. res.
R_3—900,000 ohm, ½ w. res.
R_4—960,000 ohm, ½ w. res.
R_5—980,000 ohm, ½ w. res.
R_6—990,000 ohm, ½ w. res.
R_7—996,000 ohm, ½ w. res.
R_8—998,000 ohm, ½ w. res.
R_9—999,000 ohm, ½ w. res.
R_{10}—999,600 ohm, ½ w. res.
R_{11}—660,000 ohm, ½ w. res.
R_{12}—230,000 ohm, ½ w. res.
R_{13}—110,000 ohm, ½ w. res.
R_{14}—41,700 ohm, ½ w. res.
R_{15}—20,800 ohm, ½ w. res.
R_{16}—10,100 ohm, ½ w. res.
R_{17}—4000 ohm, ½ w. res.
R_{18}—2000 ohm, ½ w. res.
R_{19}—1000 ohm, ½ w. res.
R_{20}—400 ohm, ½ w. res.
C_1 to C_{10}, inclusive—25 to 100 μμfd. var. cond.
C_{11}—48 μμfd. ceramic cond.
C_{12}—128 μμfd. ceramic cond.
C_{13}—288 μμfd. ceramic cond.
C_{14}—768 μμfd. ceramic cond.
C_{15}—1580 μμfd. ceramic cond.
C_{16}—3165 μμfd. ceramic cond.
C_{17}—7970 μμfd. ceramic cond.
C_{18}—13,980 μμfd. ceramic cond.
C_{19}—.032 μfd. ceramic cond.
C_{20}—.080 μfd. ceramic cond.
S_1—11 pos., 2 gang rot. sw.

Note: Where non-standard RMA values for fixed resistors and condensers are shown, it will be necessary to add the required combination of units to give the final value.

An eleven-step attenuator that may be substituted in place of the three-step attenuator incorporated in Fig. 2. The input resistance and capacity are 1 megohm and 32 μμfd., respectively, at all taps. Adjust condensers C_1 to C_{10}, inclusive, as described in text for the three-step attenuator. This new attenuator will be particularly desirable where more accurate measurements are desired. The three-step attenuator is somewhat coarse for normal work.

☆ ☆

Fig. 4. Diagram of power supply producing both plus and minus 300 volts.



R_1—30,000 ohm, 5 w. wirewound res.
C_1—20 μfd., 450 v. elec. cond.
C_2, C_3—20/20 μfd., 350 v. dual elec. cond.
C_4—1 μfd. @ 1000 v. cond.
C_5—16 μfd. @ 450 v. cond.
CH_1, CH_2—16 hy. @ 50 ma. filter choke
T_1—300-0-300 v. @ 55 ma., 5 v. @ 2 amp., 6.3 v. @ 2.7 amp., power trans.
V_1—5W4 tube
V_2—6X5 tube V_3, V_4—VR150 tube

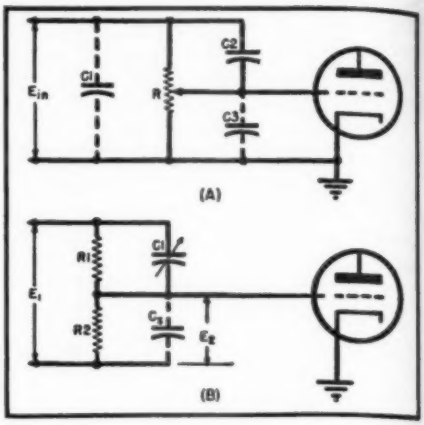


Fig. 5.

and L_3, which are shunt peaking coils. It is possible to include additional stages of amplification following the principles described above. In this case potentiometer R_{11} would be replaced by a fixed resistor.

The necessary negative 300 volts may be easily acquired from the existing power supply as shown in Fig. 4. The only current drawn is through the bleeder circuit and is insignificant. The two VR-150's included for voltage stabilization could be left out but are desirable to minimize drift due to voltage changes. Regulation of the positive voltage supply is likewise advantageous but not essential.

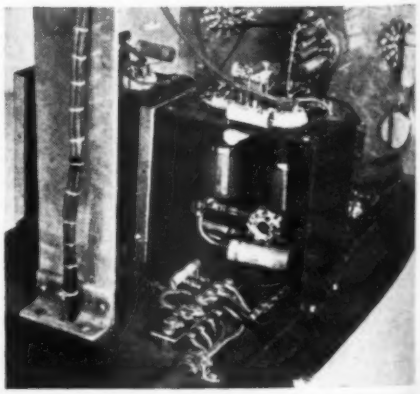
Adjustment of the Amplifier

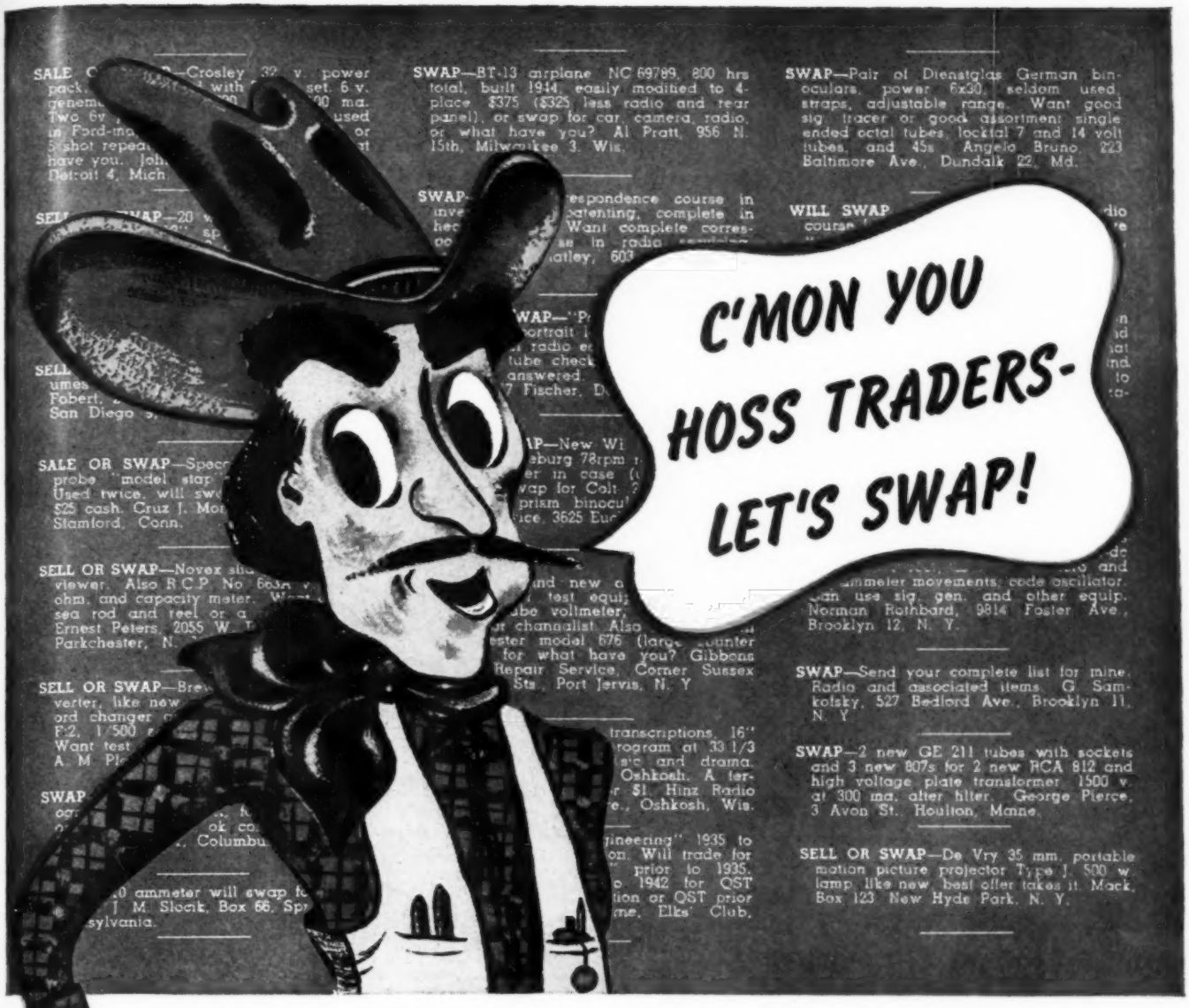
Since no two amplifiers will be constructed alike, and, therefore, will have different values of stray capacitances, it is desirable to make peaking coils L_1, L_2, and L_3 variable. Such coils may be easily constructed on a form incorporating a variable slug tuning device. In this case, the value of the inductance L_1 should be fixed at one mhy. with the slug halfway in. L_3 should be variable from about .5 mhy. to 2 mhy. to allow for discrepancies in resistors and stray capacitance. Similarly, L_2 and L_3 should vary from about 1.5 mhy. to 5 mhy.

It should be pointed out that vari-

(*Continued on page* 175)

Fig. 6. Rear view of the oscilloscope. In the center of the photograph may be seen the two 6V6's of the vertical push-pull deflection amplifier. The terminal board for all power connections is shown in the foreground.





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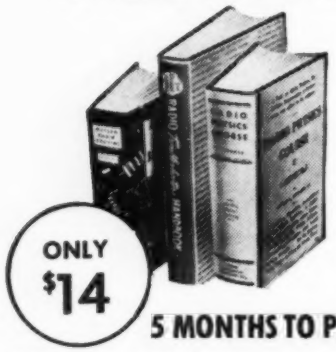

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DO YOU KNOW?

By DAVID SCOTT

101. In video amplifiers, why are even small amounts of phase shift troublesome at low frequencies?

A. *Phase shift in video amplifiers at low frequencies is troublesome because, while phase shift may be small in degree, the time delay in seconds is large.*

102. What is one effect of excessive low-frequency phase shift in video amplifiers?

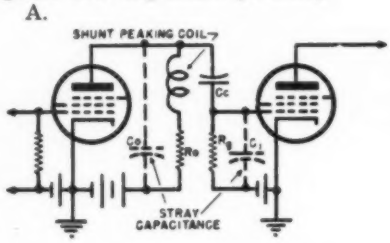
A. *Excessive low-frequency phase shift may cause a gradual change in shading from top to bottom of the picture.*

103. What is the purpose of peaking coils in video amplifiers?

A. *When the loss in high frequency is due to stray capacitance, compensation may be effected through the insertion of small inductances, called peaking coils, at strategic points in the circuit.*

104. Draw a simple schematic diagram showing shunt peaking.

A.



105. What are the limitations of shunt peaking?

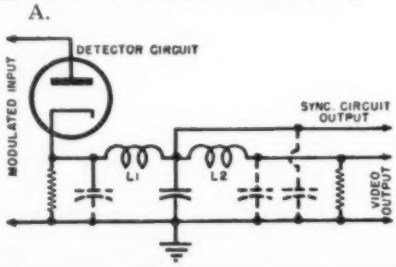
A. *Shunt peaking serves well only if the maximum frequency limit is not too high, and there are only a few stages of amplification.*

106. What is meant by filter coupling?

A. *Filter coupling is the process of connecting several peaking coils in series to improve the bandpass characteristics and to provide extra terminals from which signal energy can be taken without overloading any single point of the amplifier.*

107. Draw a simple schematic diagram illustrating filter coupling.

A.

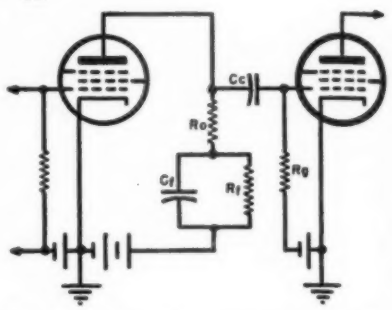


108. What is meant by combination shunt-series peaking?

A. *Shunt-series peaking is a combination of shunt peaking and series peaking to achieve the best characteristics of each.*

109. Draw a simple schematic diagram illustrating low-frequency compensation.

A.

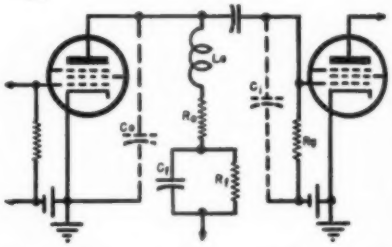


110. What is the purpose of the parallel C_f-R_f circuit in a low-frequency compensated amplifier plate circuit?

A. *The C_f-R_f filter (see question 109) provides: (1) Improvement in low-frequency response; (2) compensation for the phase shift in the coupling circuit, C_c-R_g; and (3) isolation to the impedance of the power supply deterring feedback.*

111. Draw a simple schematic diagram of a video amplifier, including high- and low-frequency compensation.

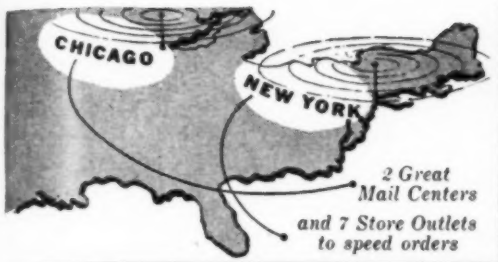
A.



112. What are some considerations in compensating multistage amplifiers?

A. *Since the amplitude-frequency characteristic of an amplifier is the product of the individual stages, and the time delay-frequency characteristic is the sum of the individual stages, it may not be possible for an amplifier to be compensated as a unit, but each stage must be treated separately. This is especially true in broadcasting where there may be 20 to 30 stages of amplification between pickup tube and final transmitter stage.*

(To be continued)



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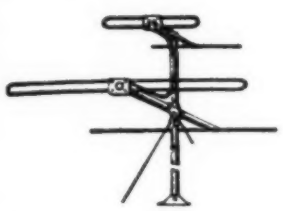

Here's a rare opportunity to pick up this excellent array at 75% off. Receives all 13 TV channels, plus the FM band. Range on the LF array: 44-108 MC.; 174-220 MC. on HF array. Average gain 2.5 db on LF array, 1.5 db on HF array above tuned dipole. Each unit can be rotated individually for maximum signal strength. Complete with 5 ft. mast. Stock up at this low price. No. 99N9612R (Shipping weight: 14 lbs.).....$6.25

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Gives you absolute peak performance all around the dial. Keeps the antenna directly "on the beam" to bring in the strongest signal on each channel. Automatic signal light goes off when cycle is completed. Antenna stops instantly on finger-tip release of remote control. Plugs in any 110 standard outlet. Fits any antenna. *Compare this price.* No. 28N21951R (Shipping weight: 8 lbs.) LIST PRICE, $29.95

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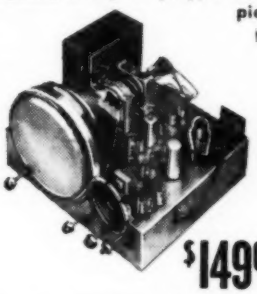
Complete, ready to play, including picture tube



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Buy it at less than you would ordinarily pay for a kit alone! You can get it only from Lafayette for your custom installation at just about *half* price! Comes to you completely wire tested and lined up, all ready for installation into cabinet. Absolute lineavity, undistorted viewing. Automatic frequency control for horizontal synchronization. Higher than average sensitivity and picture brilliance. Not a "price" set, but a precision-made receiver 15" high, 21" wide, 19" deep. Shipping weight: 75 lbs.

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You don't even need a phone line when you use this portable communications system for antenna installations. Just hook the phones onto the antenna wire and you're all set for clear 2-way conversations! No batteries needed; it's "sound powered." Also practical as an intercom system for home, shop, farm or office. Can be used as far as 25 miles apart. They're being snapped up at Lafayette's bargain price **$8.75** No. 32H14015R (Wt.: 1½ lbs.) per phone

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Top quality television power transformer with a rating of 2200 volts at 2 ma. Filament voltages: 6.3V at 1 amp., 2.5V at 2 amps. Take advantage of this special offering. No. 6N1501R (Shipping weight: 2½ lbs.).....$3.75

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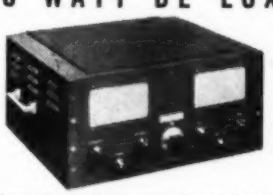

Lafayette made a sensational buy on this 20-watt high-fidelity P.A. Amplifier and passes the $40 saving on to you. We can't mention the make, but you'll recognize it as one of the most reputable in the business. Frequency response essentially flat from 50 to 15,000 cps. Separate bass and treble tone control. Master Gain Control to regulate all channels without resetting individual control. Output impedances 2, 4, 8, and 500 ohms. Input for 2 microphones and 2 record players. Fader control permit smooth fading from one record to the other. Uses 2 12SJ7, 6SJ7, 6SL7, 26L6G, plus 5Z3 rectifier. Cabinet made of heavy-gauge steel with black crackle finish. Fits standard relay rack, or can be used as individual unit. Size 19¼" wide by 17¼" deep by 9¼" high. For 105-125 60 cycle AC only. Underwriters Lab. approved. No. 2G410R (Shipping weight: 60 lbs.)

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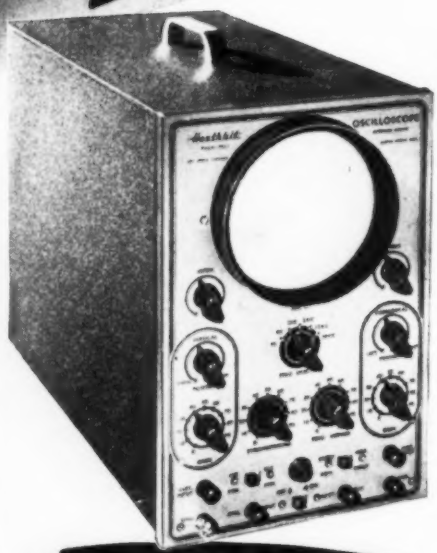
NEW 1950 Heathkits have all the Features



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New 1950 Heathkit

PUSH-PULL EXTENDED RANGE 5" OSCILLOSCOPE KIT

Features

- The first truly television oscilloscope.
- Tremendous sensitivity .06 Volt RMS per inch deflection.
- Push-pull *vertical and horizontal* amplifiers.
- Useful frequency range to 2½ Megacycles.
- Extended sweep range 15 cycles to 70,000 cycles.
- New television type multivibrator sweep generator.
- New magnetic alloy shield included.
- Still the amazing price of $39.50.

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The instrument for all—the ranges you need—beauty you'll enjoy for years and you can assemble it in a matter of minutes—an instrument for everyone. The handiest quality voltohmeter of all. Small enough to put in your pocket yet a full 3" meter. Easy pictorial wiring diagrams eliminate all assembly problems. Uses only 1% precision ceramic divider resistors and wire wound shunts. Twelve different ranges. AC and DC ranges of 10–30–300–1,000–5,000 Volts. Ohms ranges of 0–3,000 ohms and 0–300,000 ohms. Milliampere ranges of 10MA and 100MA. Hearing aid type ohms adjust control fits conveniently under thumb for one hand adjustment. Banana type jacks for positive low resistance connections. Quality test leads included. The high quality Bradley instrument rectifier was especially chosen for linear scales on AC. The modern case was styled by Harrah Engineering for this instrument. The 400 microampere meter movement comes already mounted in the case protected from dust during assembly. An ideal classroom assembly instrument useful for a lifetime. Perfect for radio service calls, electricians, garage mechanics, students, amateurs and beginners in radio. The only quality voltohmeter under $20.00. An hour of assembly saves you one-half the cost and quality parts give you a better instrument. Order today. Shipping weight 2 lbs.

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- Burn-out proof meter circuit.
- 24 complete ranges.
- Isolated probe for dynamic testing.
- Most beautiful VTVM in America.
- Accessory probes (extra) extend ranges to 10,000 Volts and 100 Megacycles.
- Modern push-pull electronic voltmeter circuit.
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- Shatterproof plastic meter face.

A new Model V-2 Heathkit VTVM with new 200 microampere meter four additional ranges—full scale linear ranges on both AC and DC of 0-3 V., 10 V., 30 V., 100 V., 300 V., and 1,000 V. Accessory probe listed elsewhere in ad extends voltage range to 3,000 and 10,000 volts D.C. New model has greater sensitivity, stability and accuracy—still the highest quality features—shatterproof plastic full view meter face—automatic meter protection, push-pull electronic voltmeter circuit, linear scales—db. scale—ohmmeter measures 1/10 ohm to 1 billion ohms with internal battery—isolated DC test prod for dynamic measurements—11 megohm input resistance on DC—AC uses electronic rectification with 6H6 tube. All these features and still the amazing price of only $24.50. Comes complete with cabinet—panel—three tubes—new Mallory switches—test prods and leads, 1% ceramic divider resistors and all other parts. Complete instruction manual for assembly and use. Better start your laboratory with this precision instrument. Shipping weight 8 lbs. *Model V-2* .....

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- New precision coils for greater output.
- Cathode follower output for greatest stability.
- 400 cycle audio available for audio testing.
- Most modern type R.F. oscillator.
- Covers 150Kc. to 34Mc. on fundamentals and calibrated strong harmonics to 102 Mc.

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The most popular signal generator kit has been vastly improved—the experience of thousands combined to give you the best. Check the features in this fine generator and consider the low price $19.50. A best buy for any shop, yet inexpensive enough for hobbyists. Everyone can have an accurate controlled source of R.F. signal voltage.

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Ideal for schools, laboratories, service shops, serious experimenters.

An impedance bridge for everyone — the most useful instrument of all, which heretofore has been out of the price range of serious experimentors and service shops. Now at the lowest price possible. All highest quality parts. General Radio main calibrated control. General Radio 1000 cycle hummer. Mallory ceramic switches with 60 degree indexing — 200 micro-amp zero center galvanometer — 1% of 1% ceramic non-inductive decade resistors. Professional type binding posts with standard ¾" centers. Beautiful birch cabinet Directly calibrated "Q" and dissipation factor scales. Ready calibrated capacity and inductance standards of *Silver* Mica, accurate to ½ of 1% and with dissipation factors of less than 30 parts in one million. Provisions on panel for external generator and detector. Measure all your unknowns the way laboratories do — with a bridge for accuracy and speed.

Internal 6 volt battery for resistance and hummer operation. Circuit utilizes Wheatstone, Hay and Maxwell circuits for different measurements. Supplied complete with every quality part — all calibrations completed and instruction manual for assembly and use. Deliveries are limited. Shipping weight, approximately 15 lbs.

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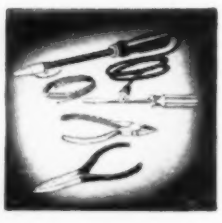

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Everything you want in a television alignment generator. A wide band sweep generator covering all FM and TV frequencies 0 - 110 and 165 to 220 Megacycles, a marker indicator covering 19 to 43 Megacycles, AM modulation for RF alignment — variable calibrated sweep width 0 - 30 Mc. — mechanical driven inductive sweep. Husky 110V. 60 cycle power transformer operated — step type output attenuator with 10,000 to 1 range — high output on all ranges — band switching for each range — vernier driven main calibrated dial with over 45 inches of calibration — vernier driven calibrated indicator marker tuning. Large grey crackle cabinet 16⅛" x 10⅝" x 7-3/16". Phase control for single trace adjustment. Uses four high frequency triodes plus 5Y3 rectifier — split stator tuning condensers for greater efficiency and accuracy at high frequencies — this Heathkit is complete and adequate for every alignment need and is supplied with every part — cabinet — calibrated panel — all coils and condensers wound, calibrated and adjusted. Tubes, transformer, test leads — every part with instruction manual for assembly and use. Actually three instruments in one — TV sweep generator — TV AM generator and TV marker indicator. Also covers FM band.

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Features

1. Measures each element individually
2. Has gear driven roller chart
3. Has lever switching for speed
4. Complete range of filament voltages
5. Checks every tube element
6. Uses latest type lever switches
7. Uses beautiful shatterproof full view meter
8. Large size 11" x 14" x 4" complete
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Check the features and you will realize that this Heathkit has all the features you want. Speed — simplicity — beauty — protection against obsolescence. The most modern type of tester — measures each element — beautiful Bad-Good scale, high quality meter — the best of parts — rugged oversize 110V. 60 cycle power transformer — finest of Mallory switches — Centralab controls — quality wood cabinet — complete set of sockets for all type tubes including blank spare for future types — fast action gear driven roller chart uses brass gears to quickly locate and set up any type tube. Simplified switching cuts necessary time to minimum and saves valuable service time. Short and open element check. No matter what arrangement of tube elements, the Heathkit flexible switching arrangement easily handles it. Order your Heathkit Tube Checker today. See for yourself that Heath again saves you ⅔ and yet retains all the quality — this tube checker will pay for itself in a few weeks — better build it now.

Complete with detail instructions — all parts — cabinet — roller chart — ready to wire up and operate. Shipping Wt., 15 lbs.

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Nothing ELSE TO BUY

$34.50

Experimenters and servicemen working with a square wave for the first time invariably wonder why it was not introduced before. The characteristics of an amplifier can be determined in seconds compared to several hours of tedious plotting using older methods. Stage by stage, amplifier testing is as easy as signal tracing. The low distortion (less than 1%) and linear output (± one db.) make this Heathkit equal or superior to factory built equipment selling for three or four times its price. The circuit is the popular RC tuning circuit using a four gang variable condenser. Three ranges 20-200, 200-2,000, 2,000-20,000 cycles are provided by selector switch. Either sine or square waves instantly available at slide switch. All components are of highest quality, cased 110V. 60 cycle power transformer. Mallory F.P. filter condensers, 5 tubes, calibrated 2 color panel, grey crackle aluminum cabinet. The detailed instructions make assembly an interesting and instructive few hours. Shipping Wt., 13 lbs.

New Heathkit BATTERY ELIMINATOR KIT

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Now a bench 6 Volt power supply kit for all auto radio testing. Supplies 5 - 7½ Volts at 10 Amperes continuous or 15 Amperes intermittent. A well filtered rugged power supply uses heavy duty selenium rectifier, choke input filter with 4,000 MFD of electrolytic filter. 0 - 15 Volt meter indicates output. Output variable in eight steps. Excellent for demonstrating auto radios. Ideal for servicing — can be lowered to find sticky vibrators or stepped up to equivalent of generator overload — easily constructed in less than two hours. Complete in every respect. Shipping Wt., 18 lbs.

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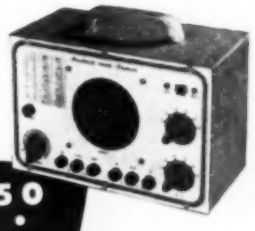

$19.50

The popular Heathkit signal tracer has now been combined with a universal test speaker at no increase in price. The same high quality tracer follows signal from antenna to speaker —locates intermittents—defective parts quicker—saves valuable service time—gives greater income per service hour. Works equally well on broadcast — FM or TV receivers. The test speaker has assortment of switching ranges to match push pull or single output impedance. Also test microphones, pickups — PA systems — comes complete — cabinet — 110V. 60 cycle power transformer — tubes, test probe, all parts and detailed instructions for assembly and use. Shipping Wt., 8 lbs.

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ELECTRONIC SWITCH KIT

DOUBLES THE UTILITY OF ANY SCOPE

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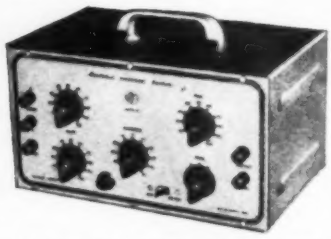


Nothing ELSE TO BUY

An electronic switch used with any oscilloscope provides two separately controllable traces on the screen. Each trace is controlled independently and the position of the traces may be varied. The input and output traces of an amplifier may be observed one beside the other or one directly over the other illustrating perfectly any change occurring in the amplifier. Distortion — phase shift and other defects show up instantly, 110V. 60 cycle transformer operated. Uses 5 tubes (1 6X5, 2 6SN7's, 2 6SJ7's). Has individual gain controls, positioning control and coarse and fine sweeping rate controls. The cabinet and panel match all other Heathkits. Every part supplied including detailed instructions for assembly and use. Shipping Wt., 11 lbs.

Heathkit
3-TUBE ALL WAVE RADIO KIT

$8.75

CABINET EXTRA

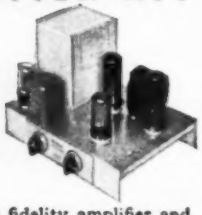
An ideal way to learn radio. This kit is complete ready to assemble, with tubes and all other parts. Operates from 110V AC. Simple, clear detailed instructions make this a good radio training course. Covers regular broadcasts and short wave bands. Plug-in coils. Regenerative circuit. Operates loud speaker. Shipping Wt., 3 lbs.

H530 Headphones per set $1.00
2½" Permanent Magnet Loudspeaker 1.95
Mahogany Cabinet 2.95

Heathkit
HIGH FIDELITY AMPLIFIER KIT

Nothing ELSE TO BUY

$14.95



Build this high fidelity amplifier and save two-thirds of the cost. 110V. 60 cy. transformer operated. Push pull output using 1619 tubes (military type 6L6's), two amplifier stages using a dual triode (6SL7), as a phase inverter give this amplifier a linear reproduction equal to amplifiers selling for ten times this price. Every part supplied; punched and formed chassis, transformers (including quality output to 3-8 ohm voice coil), tubes, controls, and complete instructions. Add postage for 20 lbs.

12" PM Speakers for above $6.95

Mahogany Speaker Cabinet, 14½" x 14½" x 8" $8.75

New Heathkit
FM TUNER KIT

CABINET EXTRA

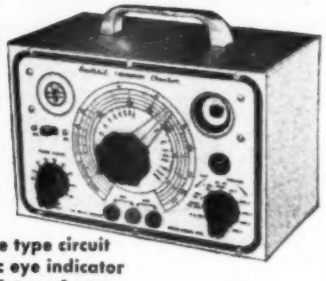
$14.75

A truly fine FM Tuner with the coils ready wound, all alignment completed — all that is necessary is wiring and it's ready to play — uses super regenerative circuit — 110V. 60 cycle transformer operated — two gang tuning condenser — slide rule calibrated dial — two tubes — complete instructions including pictorial enable even beginners to build successfully. Shipping Wt., 4 lbs.

Beautiful mahogany cabinet for FM Tuner (shown above) extra $3.75

Heathkit
CONDENSER CHECKER KIT

$19.50



Features

- Power factor scale
- Measures resistance
- Measures leakage
- Checks paper-mica-electrolytics
- Bridge type circuit
- Magic eye indicator
- 110 V. transformer operated
- All scales on panel

Checks all types of condensers, paper-mica-electrolytic-ceramic over a range of .00001 MFD to 1000 MFD. All on readable scales that are read direct from the panel. NO CHARTS OR MULTIPLIERS NECESSARY. A condenser checker anyone can read without a college education. A leakage test and polarizing voltage for 20 to 500 volts provided. Measures power factor of electrolytics between 0% and 50%. 110V. 60 cycle transformer operated complete with rectifier and magic eye tubes, cabinet, calibrated panel, test leads and all other parts. Clear detailed instructions for assembly and use. Why guess at the quality and capacity of a condenser when you can know for less than a twenty dollar bill. Shipping Wt., 7 lbs.

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PE101C BC645 POWER SUPPLY

NO. 273. Complete power supply for BC 645. Operates from 12 or 24 Volts. Supplies both AC and DC required. Shipping Wgt. 13 lbs. Each **$3.95**

DM 35 12 VOLT DYNAMOTOR

NO. 274. New input 12 Volt at 18.7 Amperes. Supplies 675V at 275 MA or ½ above voltage from 6 volts. Excellent for auto use. Shipping Wgt. 11 lbs. Each **$7.50**

HOME WORKSHOP GRINDER KIT

NO. 230. Easily assembled 110V AC or DC ball bearing fully enclosed motor from Army surplus dynamotor. Purchaser to make simple changes and shaft extensions, detailed instructions and all parts supplied. Motor approximately 5,000 R.P.M. Ideal for tool-post grinder, flexible shaft tool, model drill press, saw. Shipping Weight 6 lbs. **$3.95**

COLLINS AUTOTUNE CONTROL HEAD

NO. 278. Brand new controls used on the ART/13, 100 Watt, Transmitter. Types 7, 8, 10, and 11 available. Get a spare while available as new cost is over $22.00 each. Shipping Wgt. 3 lbs. Price any type (mention when ordering). Each **$4.50**

300 MA SELENIUM RECTIFIERS

NO. 209. Rated 300 MA at 36 Volts, complete with mounting brackets. Shipping Wgt. 1 lb. 3 FOR $1.00

1N90 FEED THROUGH INSULATOR

NO. 276. Heavy duty feed through, 2" diameter 4" long, complete with brass hardware and gasket. Shipping Wgt. 2 lbs. 2 FOR **$1.00**

1N86 STRAIN INSULATOR

NO. 277. Husky army type 1¼" diameter, 5¼" long. Brown porcelain. Shipping Wgt. 4 lbs. 4 FOR **$1.00**

G.E. BC 306 ANTENNA TUNING UNIT

NO. 231. Matches any aerial to 150 Watt transmitter, used on BC 375. Brand new. Add postage for 20 lbs. **$2.95**

G. E. 1,000 VOLT 350 MA DYNAMOTOR

NO. 213. An ideal dynamotor for mobile operation in taxicabs, police cars, sound systems and amateur stations. Supplies above voltage from 12 Volts or 500V. at 350 MA from 6 Volts. Complete with starting relay, and fuses. New. Our Dynamotor A. Shipping Weight 72 lbs.

$5.95

POWER TRANSFORMER *Specials*

NO. 226. Primary 117V. 60 cycle. Secondaries supply 746 V.CT at 220 MA, 6.3V. at 4.5 A., and 5V. at 4A. Will handle 13 tube radio receivers. Supply is limited, order early. Shipping Weight 11 lbs. each.
$3.95 . . 3 for $9.95

T32 TABLE MICROPHONE

NO. 210. One of the Army's best. Built by Kellogg, ideal for factory call system, public address, amateur use. Brand new in original cartons. Add postage for 5 lbs. **$2.95**

MINIATURE ELECTRIC MOTOR

NO. 211. Tiny Delco motor only 1" x 1¼"x2" 10,000 RPM. Operates from 6 to 24 V. Excellent for models. Add postage for 1 lb. **$2.95**

OUTPUT TRANSFORMER

NO. 227. Push pull 6V6's to 6 - 8 ohm voice coil excellent characteristics, **3 for $1.95**

RCA SATURABLE REACTOR TRANSFORMER

NO. 246. New RCA No. CKV30531 AC current 750 MA DC current 2 Amperes. Rated 1.75 henries. Shipping wgt. 4 lbs. Each **$1.00**

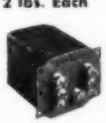
12.6V POWER TRANSFORMER

NO. 247. New cased 110 V 60 cy. Power Transformer. Supplies 440V Ct. at 60 MA, 6.3V at 2A. and 12.6V at 1 Amp. Excellent for military sets. Shipping Wght. 6 lbs. Each. **$1.95**

RCA INPUT TRANSFORMER

NO. 248. Heavy duty RCA No CKV-30529. Input has primaries 600 to 200 and 25 ohms secondary 250,000 ohms C.T. Shipping Wgt. 2 lbs. Each **$1.00**

FEDERAL POWER TRANSFORMER



NO. 252. New cased 110V 60 cy. Power Transformer. Supplies 480V CT at 50 MA and 6.3 V at 2.1 Amps. A beautiful transformer. Shipping Wgt. 4 lbs. Each **$1.50**

MILITARY POWER TRANSFORMERS

NO. 229. Convert your military receivers without rewiring the filament. "A" type supplies 500 VCT at 50 MA, 5V. at 2A. and 24V. at ½ A. "B" type supplies 500 VCT at 50 MA, 5V. at 2A. and 12V. at 1 Amp. State whether A or B type desired. Shipping Weight 4 lbs. **$2.95**

WALKIE TALKIE TRANSFORMER

No. 744. Carbon microphone input transformer and output to headphone transformer, all in one case, excellent for building your own. Shipping Wt. 1 lb. 4 for $1.00

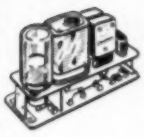
LOW PASS FILTER UNIT

No. 637. 3000 cycle cutoff consists of 3 inductances and 4 capacitors in network, 500 ohms in and out. Excellent for clipping all frequencies above 3000 cycles. Drawn steel case, shipping Wt. 5 lbs. $2.50

FM PUSH BUTTON TUNER

NO. 224. Brand new ten push button tuning assembly from Army FM receiver. Contains 4 gang 100 MMF silver plated tuning condenser. Add postage for 10 lbs. **$2.50** EACH

BC 746 TUNING UNIT



NO. 257. Plug in transmitter tuning unit from army Walkie Talkie. Contains antenna and tank coils, tuning condenser, transmitting and receiving crystals. Ideal transmitter foundation. Shipping Wgt. 1 lb. Each **$1.00**
(Same as above except transmitter crystal in 80 meter amateur band $2.50 each)

T30 THROAT MICROPHONE

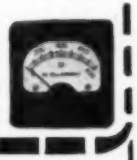
NO. 258. Makes excellent contact microphone for musical instrument or vibration pick-up. Shipping Wgt. 1 lb. $1.00 each
Extension cord with switch for above $ .50 each

BC731 CONTROL BOX

with Weston Model 476 AC Voltmeter

NO. 208. Excellent buy in meter control box. Size 8"x10"x3½". Contains Weston 0-150V. AC 3½" voltmeter, motor starting switch, 28 fuses all 30 Amp 110V. and 8 fuse holders. Fuses and holders alone worth the price. Shipping Weight 18 lbs. **$7.95**

METER SPECIAL



NO. 237. Brand new DeJur Model 312 0-800 M.A. D.C. Square 3" 0-10 M.A. basic meter with built in shunt. Probably the best buy ever offered in a surplus meter. Shipping Weight 1 lb. **$2.95**

HEARING AID HEADPHONES

NO. 216. The Army's best — eliminate flat ears and outside noise. Complete with transformer for conversion from low to high impedance. With cord and plug complete.
Add postage for 1 lb. **$1.00**

BC 451 CONTROL BOX

NO. 236. Control box for 274N transmitters. Contains proper cw-voice switch, 4 channel switch, power switch, mike jack and telegraph key.
Add postage for 2 lbs. $1.95

100 MA FILTER CHOKE

No. 641. Heavy 1.5 henry choke in drawn steel case, 50 ohm resistance, conservatively rated at 100 MA. Shipping Wt. 1 lb. 50c

FILAMENT TRANSFORMER

No. 922. 220V. 60 cy. primary supplies 12.6V. at 3.5 Amps, 15.6V at 1 Amp. Supplies 6.3 at 3.5 Amps and 7.8V. at 1. Amp from 110V. Shipping Wt. 8 lbs. $1.50

PANEL METER

Burlington O-300 VAC Meter

No. 290. Model 32XA 3½" round AC Voltmeter 0-300 VAC full scale. Scale also calibrated 0-600V. Bakelite case. A beautiful meter in original carton. Shipping Wt. $3.95

DRIVER TRANSFORMER

No. 651. Couples 3000 ohm plate to push pull parallel grids hermetically sealed. Ship. Wt. 1 lb. $1.00

OUTPUT and MODULATION TRANSFORMER

No. 745. Companion transformer to above driver. A push pull output, 3000 ohms to 3.2 ohm voice coil, or to 1250 ohms at 80 MA. A high quality cased unit. Shipping Wt. 2 pounds. $1.00

HOW TO ORDER . . . GIVE PART NUMBER AND DESCRIPTION . . . ADD POSTAGE FOR WEIGHT SHOWN. NO ORDERS UNDER $2.00 . . . WE WILL SHIP C.O.D.

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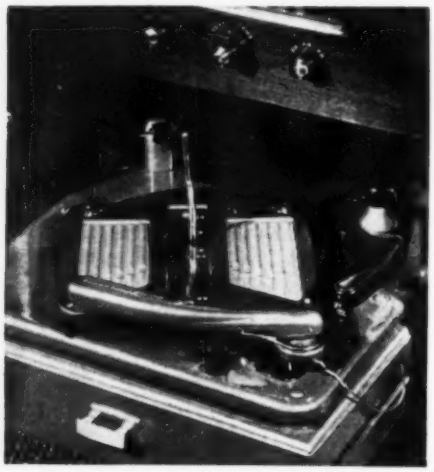
What's New in Radio

"PLAYSALL" RECORD PLAYER

Carbonneau Industries, Inc., Grand Rapids 2, Michigan, has come out with a record player unit which instantly converts any phonograph into a 3-



speed instrument able to play 33⅓, 45, and 78 r.p.m. records.

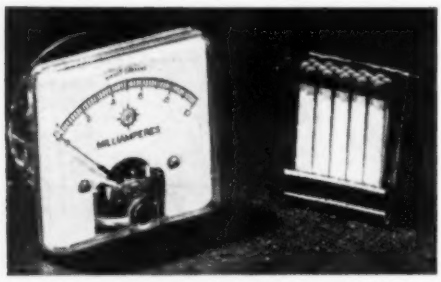
Design of this unit, called the "Playsall," makes it easy to connect. The device has stimulated the sale of 33⅓ and 45 r.p.m. records wherever it is demonstrated.

It is constructed of lightweight aluminum, complete with a featherweight tone arm and new permanent type needle. Weighing only 8 ounces, it can be slipped off the spindle as easily as a record and may be stored in the record compartment when not in use.

ASSEMBLY PRODUCTS PANEL METER

A new panel meter manufactured by *Assembly Products, Inc.*, of Chagrin Falls, Ohio, features a clear plastic case for a modern appearance, besides the desirable characteristic of being interchangeable with present 2½ inch types. The front of the meter measures 2 7/16 inches by 2⅝ inches and fits in the same panel mountings as does the 2½ inch square meter.

A wide variety of ranges is available, from 20 microamperes to 50 am-



peres, and 5 millivolts to 500 volts, all self-contained. Higher ranges of volts or amperes are possible with external shunts or multipliers. Rectifier types for a.c. measurements and r.f. types are also obtainable.

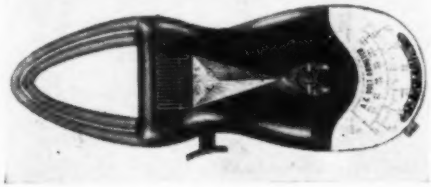
Front and back of the casing are clear for easy examination of the inside of the motor. The housing of crystal polystyrene is high heat resistant, shatterproof, and does not cast a shadow on the dial.

POCKET AMPROBE

The *Pyramid Instrument Company*, 49 Howard St., New York, has announced a new design of split-core volt-ammeter in the pocket-type Amprobe. A plastic finger trigger opens the transformer probes and clamps around the conductor, measuring the current in that circuit.

Measuring only 7⅛ inches long by 2 9/16 inches wide by 1⅛ inches thick, the Amprobe is intended to be a rugged pocket instrument for the electrician, repair shop owner, and maintenance man. It is very convenient in size, being only half as large as the usual type of volt-ammeter. The plastic trigger and 7-position selector switch can be operated by the hand holding the instrument.

Two models are available, each with seven ranges: Model A-5 is 6.5/13/26/65/130 amps and 130/260 volts; Model



A-6 is 10/25/50/198/250 amps and 150/600 volts. The Amprobe is completely insulated; no metal parts come in contact with the operator. A nylon coating over the probe jaws offers resistance to abrasion and is chip-proof.

DIRECT CURRENT KITS

Opad-Green Company in announcing its recently developed direct current power supply kits states that although they are primarily designed for testing and ground operation of aircraft and marine equipment, they are also suitable for broadcast control relays and signal lights.

These kits, which deliver 24 to 28 volts from a 115 volt, 50/60 cycle a.c. source, are available in 2, 5, 10, 15, and 20 ampere capacities, and each unit features a primary tapped transformer that permits adjustment of the d.c. output voltage. Other features are a full wave bridge type rectifier and a filter network that maintains ripple within 2 per-cent under full load conditions.

Addressing the company at 71 Warren St., New York 7, N. Y., will bring complete details on these power supply units.

EICOR "PRESIDENT" RECORDER

Eicor, Inc., 1501 W. Congress St., Chicago 7, Ill., manufacturer of rotary and electronic equipment, has intro-

duced a tape recorder that offers improvements on its "Senator" model. The new magnetic tape recorder, the "President," Model 1000 A, has a six-inch speaker and two watts output. Frequency response is flat from 100 to 4000 cycles. Like the "Senator," the new recorder has a high-fidelity, five-tube a.c. amplifier.

Encased in plywood, styled with tan morocco leatherette, the entire unit is completely portable, weighing but 27 pounds with accessories. Storage space is provided for the sensitive crystal microphone, cord, and extra reels of magnetic tape in the five-inch or large seven-inch sizes.

SYLVANIA 16AP4 TUBE

Sylvania Electric Products Inc., 500 Fifth Avenue, New York 18, N. Y., recently announced that its 16 inch metal direct-view television tubes are now being manufactured and are available

for distribution. Advantages of the tube that are stressed are increased physical strength, a reduction in weight of approximately 50 per-cent, a relatively flat face, and an ion trap gun that eliminates ion damage to the screen.

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Here is Television at its finest! . . . brought to you by Midwest, for 30 years a leader in the field of radio and electronics. Immense 151-square-inch screen on new 16" metal-glass tube . . . clear, steady, bright pictures . . . Synchronized sound and picture that a child can tune in perfectly . . . Highest quality FM sound . . . Big 12" Electro-Dynamic Panasonic Speaker. Available in beautiful Consoles or in complete chassis as illustrated (not a kit, but a complete Television receiver ready to plug in and play) to place in your own cabinet. And you can buy Midwest Television at Low Factory Prices, with Low Down Payment and Long Easy Terms — and on 30 Days Trial!

LOW FACTORY-TO-YOU PRICE

30 DAYS TRIAL

Not a KIT . . . This is a Completely assembled Receiver

. . . also a Magnificent Line of NEW 1950 MIDWEST RADIOS

featuring the latest Improved FM Circuit and the New 3-SPEED RECORD PLAYER

Powerful new 1950 Series 16 and Series 12 AM-FM Radio in complete chassis. Also beautiful new Console models including the magnificent Symphony Grand Radio-Phonograph with latest FM circuit and new 3-Speed Automatic Record Player. New portable and Table Models also available.

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NEW *Telecote* Means NEW Life for *Teletower*

Armor-Tough Coating Can't Flake Off!

WITHOUT A PENNY'S INCREASE IN THE *LOW* PRICE, Penn's Teletowers and Thriftowers are now being finished with Telecote—the new, armor-tough coating that can't flake off. Developed by one of America's leading steel makers, the use of Telecote in the television tower field is exclusive with Penn. Telecote is *impervious to weather* . . . protects equipment . . . reduces servicing . . . preserves the sparkling appearance of the tower when new.

Telecote is one of the most important new developments in the whole field of television accessories. Profit-minded dealers will write today for details.

PRICES TO RETAILERS (Shipped prepaid)

THRIFTOWER "30" —. Composed of 20' of tower welded as a single unit with 10' 1" O.D. adjustable pole, total approximately 30' overall $24.75
THRIFTOWER "40" — Composed of 20' of tower, same as *Thriftower 30*, with 20' 1" O.D. doubly reinforced adjustable pole giving a total overall extended height of approximately 40' $29.75

PENN *Teletower*
Penn Boiler & Burner Mfg. Corp.
Makers of Penn
Packaged Heat
ESTABLISHED SINCE 1932
LANCASTER, PA.

Approximate dimensions of the tube are a diameter of 15⅞" and an overall length of 22¼"; minimum useful screen diameter is 13¼". Operating voltage of the high-voltage anode is 12,000 volts; of the focusing anode, 300 volts; of the control grid, minus 33 to minus 77 volts.

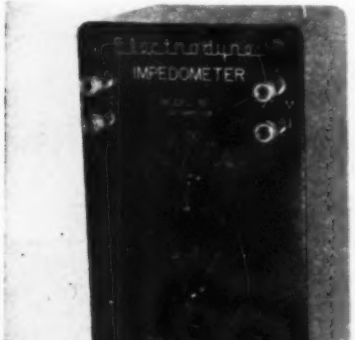
This new tube is supplied with a heater rated at 6.3 volts, a.c. or d.c. at 0.6 amperes for unipotential cathode. Magnetic deflection, focusing, and ion trap auxiliaries are required.

ELECTRODYNE IMPEDOMETER

An Impedometer developed by Edward S. Shepard of the Seismological Department of Boston College is being manufactured by the *Electrodyne Company*, 899 Boylston Street, Boston 15, Mass.

Some of the determinations possible by means of this instrument are impedance changes due to mechanical changes, effect of d.c. in circuit components, transformer characteristics, separation of resistive and reactive components, vacuum tube circuit studies, and a.c. characteristics of batteries.

Measuring impedances from .1 to 100,000 ohms through a wide range of frequencies, the Impedometer provides the means for comparing the voltage drop across the unknown impedance



with that across a resistive standard, with the same current in each. It uses standard resistors accurate to 1 percent. No specialized experience is required to operate it.

NEW AUDIOGRAPH RECORDER

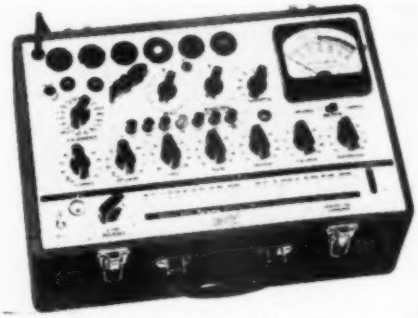
Audiograph Co., located at 1420 El Camino Real, San Carlos, California, has brought out a tape recorder that incorporates a new type of amplifier combining constant-current output with pre-emphasis equalization. The tape speed of 7½ inches per second provides plus or minus 2 db. response from 50 to 10,000 c.p.s.

Making a combined weight of 80 pounds, the unit is housed complete in two carrying cases, with five separate amplifiers, tape-transport mechanism, and electric interlocking controls in one, and the power supply, monitor speaker and storage space in the other.

The mechanical unit holds 1200 feet of tape on standard reels, and the power for tape takeup and feedoff is provided through a fluid-drive device which causes the reels to rotate in opposite directions to prevent tape overthrow. The controls are interlocked to prevent accidental tape erasure, or other operating errors. Marking aperture and counter are included for ease in editing.

PORTABLE TUBE TESTER

A lightweight, portable dynamic mutual conductance tube tester, Model



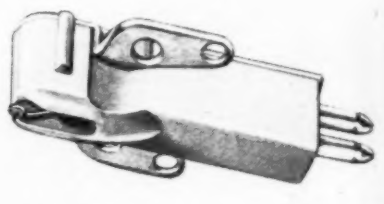
600, has been introduced by *The Hickok Electrical Instrument Co.*, 10524 Dupont Avenue, Cleveland 8, Ohio. The company states that although the unit is smaller and lower in cost than its other instruments, it is designed for lasting accuracy.

The instrument tests all tubes for AM, FM, or television, with scale readings directly in micromhos, the ranges being 0-3000-6000-15,000 micromhos. The entire size of the portable case, which is attractively built, is 7½ by 11¾ by 16¾ inches, and the weight does not exceed 15 pounds. Write to Mr. H. D. Johnson, at the above address, for complete information on this technician's tool.

ORTHOGONAL TORQUE CARTRIDGE

Designed as replacement in *RCA* 45 r.p.m. changers, a new Series 34 orthogonal (vertical type) torque drive crystal phono cartridges is being offered by *Electro-Voice, Inc.*, Buchanan, Michigan. The cartridges come in two types: Model 34 with a replaceable osmium 1 mil needle, and Model 34-S with a replaceable sapphire 1 mil needle.

These cartridges are small, yet offer all features of the E-V torque drive, and track at 5 grams pressure.



Output is 1.1 volt on *RCA* 12-5-31V records at 1000 c.p.s. Compliance is high, and frequency response is smooth, peak-free out beyond 10,000 c.p.s. A special silicone moisture-proofing is said to increase crystal life some 20 times.

Aside from these cartridges, *Electro-*

Voice is also making available the Series 14 torque drive crystal cartridge as replacement for E-V torque drive cartridges used as original equipment in other 45 r.p.m. changers. This is available with or without mounting hardware and with replaceable 1 mil osmium or sapphire needle.

HOLL UTILITY LOUDSPEAKER

A specialty of the *Holl Audio Industries*, 3133 Hollycrest Drive, Los Angeles, California, is a speaker designed

and manufactured specifically for sound enthusiasts.

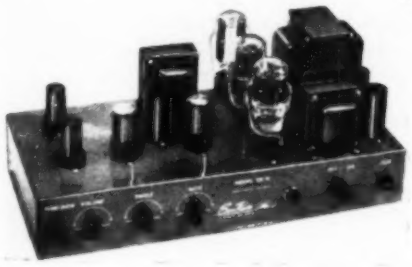
This *Holl* Model 60 has long column loading with a concave refractor that guides the speaker back waves in and out of the cabinet with maximum velocity and a minimum of sound absorption. The loudspeaker is a 12 inch p.m. Alnico-V with a voice coil of 8 ohms and a power rating of 15 watts. The cabinet is finished in utility grey paint.

Holl Audio Industries exhibited seven different models at the Fifth Pacific Electronic Exhibit recently.

AMPLIFIER KIT

A high-fidelity amplifier kit based on a recently published design by Consumers' Research, Inc., Washington, N. J., consisting of a 10-watt, 7 tube unit with a flat frequency response (± 1 db.) from 20 to 15,000 cycles, is being distributed by *Sun Radio and Electronics Company, Inc.*, 122-124 Duane St., New York 7, N. Y.

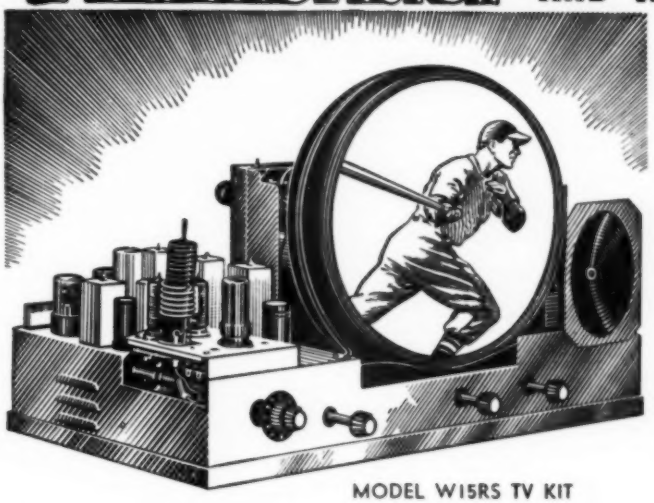
The instrument is available in two ways, as a kit or completely wired



and tested. In kit form, the unit (Model CR-10) comes with a punched chassis finished in hammertone gray with silk-screened front panel indications. Step by step instructions, photographs, and diagrams are provided. Kit price is $42.50; assembled, the unit is $69.50.

—30—

TRANSVISION TELEVISION KITS AND INSTRUMENTS



MODEL W15RS TV KIT

Build it in 1 Day!

GIANT 160 Sq. In. PICTURE Has 16" PICTURE TUBE

(All-Glass Picture Tube, giving bright, clear, steady picture.)

- **KIT COMES SEMI-WIRED and ALIGNED Can be completed in one day!**
- **SAVE by installing the set yourself.**

• LESS THAN $200!

SAVE UP TO ½ **on the cost of equivalent picture-size sets. For *NEW LOW PRICES*, see your Transvision Outlet listed below.**

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Improves Installations! ! Saves ½ the work! !

Has numerous features and advantages, including—(1) Measures actual picture signal strength . . . (2) Permits actual picture signal measurements without the use of a complete television set.

(3) Antenna orientation can be done exactly . . . (4) Measures losses or gain of various antenna and lead-in combinations . . . (5) Useful for checking receiver re-radiation (local oscillator) . . . (6) 12 CHANNEL SELECTOR . . . (7) Amplitudes of interfering signals can be checked . . . (8) Weighs only 5 lbs. . . . (9) Individually calibrated. . . . . (10) Housed in attractive metal carrying case . . . (11) Initial cost of this unit is covered after only 3 or 4 installations . . . (12) Operates on 110V, 60 Cycles, AC.

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Model FSM-1, complete with tubes Net $79.50

TRANSVISION ALL-CHANNEL TELEVISION BOOSTER

CONTINUOUS TUNING

Model B-1. . . . . List $32.50

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FLAGEL FORM ANTENNA made by G. E. all steel-copper clad, comes in 22" sections, screw together making one solid pole. Sets in heavy insulator with stake and guying equipment. Wonderful for Marine, Home and farm use. 25 foot..$3.95

BC-223A Transmitter. 2000 to 3000KC without tubes—with one tuning unit. Brand New **$12.95**
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Standard Brands—All Brand New

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2C34	.39	6K6	.59	807	1.29
2X2	.59	6SA7	.66	815	2.49
3C24	.39	6SH7	.29	837	2.49
3C30	.79	6SQ7	.59	843	.69
4B25/		6X5	.59	922	1.49
6CF	5.95	15R	.79	8012	1.95
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3" Round & Square 0-15 Mil DC.
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1 Mfd. 2000 G.E. .....$ .85
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SELSYN MOTORS—50V 50/60 cycles. Can be used to turn small beam antenna or as indicators. 3½" diameter x 5½" high. Two can be used in series on 110V AC. Brand New. Per Pair.....$4.95

WATTHOUR METERS—Westinghouse, metal case, 115-120 volt 60 cycle—5 amp, single phase $4.95
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TS-10 Sound Power handsets. Brand New. Each, $15.00. 2 for.....$27.95

FRENCH TYPE PHONE—TS-13C Hand Set—butterfly switch on handle, 6 ft. cord with PL55 plug for earphone and PL68 for mike.....$3.95

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AFCA NEWS

This Association is a patriotic non-profit organization, with chapters in most of the larger cities, dedicated to developing and maintaining efficient personnel, commissioned, enlisted, civilian, for the supply (including design and development), installation, maintenance and operation of communications and electronic equipment for Army, Navy and Air Force and their supporting civilian activities. It publishes a magazine "SIGNALS" at its national headquarters in Washington. Every American interested in any way in communications is eligible and invited to join. Further details may be obtained by addressing the secretary at 1624 Eye St. N. W., Washington 6, D. C.

* * *

1950 Annual Meeting

Initial plans have already been made to hold the fourth annual meeting of the Association at New York City, Astoria, L. I., and Fort Monmouth, N. J., on April 26, 27, and 28. The meeting will be sponsored by the Army and will feature the latest in Signal Corps developments. The 1949 meeting was held in Washington, D. C., under Navy sponsorship; the 1948 meeting took place at Wright Field, Ohio, under Air Force guidance.

Signal Corps ROTC Camp Award

At the final review of the 1949 Signal Corps ROTC Camp at Fort Monmouth, N. J., July 28th, the first annual AFCA award to the honor cadet at the camp was made. Robert G. Chamberlin of the State College of Washington was selected by camp authorities as the recipient. Mr. Fred R. Lack, AFCA President and vice-president of *Western Electric Co.*, made the presentation of the award, which consisted of a scroll, a special AFCA medal for wear on the ROTC uniform, a lapel emblem for wear on civilian clothes, and an honorary membership in AFCA. Of special significance to Cadet Chamberlin was a copy of General Dwight D. Eisenhower's historical book, "Crusade in Europe," personally inscribed, "To the No. 1 ROTC Student, Summer Camp, Fort Monmouth, N. J., 1949. With congratulations from Dwight D. Eisenhower." The informal presentation of the book was made for General Eisenhower immediately after the review by Brig. Gen. S. H. Sherrill, AFCA Executive Director, who had been commander of ROTC camps at Fort Monmouth for three summers in the 1920s while on duty as Asst. PMS&T at Carnegie Institute of Technology.

The importance to national defense of this first annual award was emphasized by the presence in the reviewing party of many civilians and military leaders distinguished in the communications field. Fort Monmouth's commander, Maj. Gen. F. H. Lanahan, Jr., addressed the ROTC students during the ceremony, explaining the purpose of the AFCA award and of the Association itself, membership in which is open to all students. He then introduced the guests who had come from New York and Washington. They included: Maj. Gen. Spencer B. Akin, Chief Signal Officer; Maj. Gen. J. O. Mauborgne, former Chief Signal Officer; Maj. Gen. W. H. Harrison, president of *IT&T Corp.;* Maj. Gen. G. L. Van Deusen, president of *RCA Institutes;* Brig. Gen. C. H. Arnold, who has directed the procurement and distribution of all Signal Corps supplies for the past four years; Dr. H. H. Buttner, president of *Federal Telecommunication Labs.;* Brig. Gen. C. O. Bickelhaupt, vice-president of *AT&T Co.;* Brig. Gen. Harry Reichelderfer, recently appointed director of the Signal Corps Engineering Labs; and Col. Ralph Hart of the *Western Electric Co.*

AFCA CHAPTER NOTES

Far East

The annual convention of the Far East Chapter was held at the Union Club in Tokyo on June 30th. The principal speaker was Lt. Gen. George E. Stratemeyer, commanding general of the FEAF. Brig. Gen. George I. Back, chapter president, presided over the meeting and introduced the various distinguished representatives of the Army, Navy, and Air Force and the communications industry in Japan.

Greater Detroit

The first fall meeting will feature a lecture and demonstration of the Air Force's tri-dimensional photography show by Col. George W. Goddard, Chief, Photographic Laboratory, Engineering Div., USAF.

Louisiana

A business meeting was held on June 7th at the St. Charles Hotel, New Orleans. The chapter constitution and bylaws were adopted, and officers were elected for the ensuing year as follows: President—Peter M. Miller of the *New Orleans Public Service;* vice-presidents—Capt. Glenn W. Legwen, USN; Col. A. H. Schroeder, USA; Col. Herbert B. deBuys, AAF-Res.; George W. Healy, Jr.; Curtis G. Walther; C. J. Briant; the Rev. Thomas J. Shields, S. J., president of Loyola University; treasurer—George A. Mayoral of Station WRCM; secretary—A. B. Hay of *Southern Bell T&T Co.*

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211	.28	6C4	.28
803	3.63	6AR5	.54
805	3.63	6D6	.55
813	6.90	6K7GT	.54
815	1.37	6SH7	.27
843	.38	6SS7	.53
954	.18	7C4	.28
955	.18	12A6	.28
957	.18	12H6	.29
958A	.18	12K7GT	.53
1619	.18	12SH7	.29
1625	.18	12SR7	.29
1626	.18	28D8	.29
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9004	.18	50B5	.55
9006	.18	50L6GT	.54

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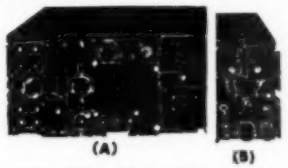
Compare these prices with our full page listing elsewhere in this publication.

SCR 506-A Transmitter and Receiver



(A) (B)

(B) RECEIVER BC 652-A

BC-652-A is an eleven tube superhet. receiver with a frequency range of 2,000 to 6,000 kc. (75-80 mtr ham bands), crystal frequency standard and 12V dynamotor DM-40-A on two separate chassis combined in one case. Tube line-up consists of 12SG7—R.F., 12K8Y—Converter, 12SK7—1st I.F., 12C8—2nd I.F., and noise limiter, 12SK7—3rd I.F., 12K8Y—B.F.O., 12SK7—1st Audio, 6Y6G—2nd Audio, 6K8—Crystal Oscillator, 6SC7—20Kc Multivibrator, and 6SC7—100 Kc Multivibrator. Sensitivity is 1 microvolt or greater. Front panel contains all controls and is ribbed for protection against damage. **Unit requires absolutely no conversion other than addition of proper power supply.** Brand new in original overseas shipping crates.

Cat. No. N-176.
YOUR COST **$39.95**

(A) TRANSMITTER BC653-A

BC-653-A is a 7-tube, variable frequency transmitter with range of 2,000 to 4,500 kc. modulator, voltage regulator and DM-42-A dynamotor, all self contained in one case. Tube lineup consists of 1613 master oscillator, 807 buffer, two parallel 814 power amplifier, 1613 modulator and two 03C-105 voltage regulators. Power input: 100 watts C.W. and 25 watts phone. Principal feature is the speed with which any of five pre-set frequency channels can be selected from the front panel. BC-653-A transmitter, brand new with all tubes and 12 V. Dynamotor, packed in original, unopened crates.

Cat. No. N-177.
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- **SONAR VFX 680** F.M. VFO and exciter, L.N. **69.00**
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- **BEACH Model 1700** 80 meter VFO, new . . **19.95**
- **GON-SET** 50-54 Mcs. converter, like new . **27.50**
- **RME-69** with spkr., excel. **79.95**
- **SPERTI** handy talky, excel. **24.95**
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- **McMURDO SILVER 700** 2mtr. xmtr. COMPLETE **34.95**
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- **JQ NAVY 6v. portable** audio amplif. Very Good **9.95**
- **BC 221 freq. mtr.** w/xtal & calib. book, EXC. **75.00**
- **BC 342 NAVY** communications rcvr. 110 v. ac. **75.00**
- **MARK II** tank xmtr. brand NEW, complete **34.95**
- **CRV NAVY Rcvr.** 100-1500 kc. w/tubes Very good **14.95**
- **T2-27/TSM** resistance bridge (w/galvano-mtr.) **75.00**
- **BC-939-A Ant. tuner** for BC-610, NEW . . **55.00**
- **BC-614-D speech amplifier** for BC-610, NEW **45.00**
- **W1252 electronic wavemeter,** 22-30 Mcs. Exc. **49.95**

BC 728 PORTABLE RECEIVER CHASSIS

6 tube, 4 channel chassis — push-button controlled. 2 to 6 mc. covers marine, fire, police, aircraft and amateur freq's. Uses battery type tubes. Has T.R.F. and Audio Stages. All coils slug tuned in a very sensitive superheterodyne circuit. Small, compact and very desirable. Easily converted to broadcast. Schematic furnished.

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LESS TUBES **$2.25**

Kit of 6 tubes: 3—1T4, 1—1R5, 1—1S5, 1—3S4. Special **$4.72**

GET ON 160 METERS NOW!

NAVY ARC-5 Transmitters. 2.1 to 3 mcs. Retuning 2 self-contained padders puts you on 160—entire job takes 5 minutes! Very few available at any price. Brand New in Original Cartons.

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110VAC Power Supply Kits for any 274N or ARC-5 XMTR available.

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SPLIT-STATOR XMTR CONDENSER

Hammarlund 35 mmfd per section split stator variable transmitting condenser. Steatite mounting base, variable soldering lug-contacts. Special shield between sections, ¼" shaft.

Cat. No. N-126.
A REAL BUY AT **89c**

50 MMFD TUNING CONDENSER WITH MOUNTING BRACKET

TVI got you licked? Don't give up, O.M.! Operate, but co-operate by installing this 50 mmfd. ceramic mounted, tuning condenser as part of the plate circuit, series tuned trap. Drilled and tapped bracket provided for convenience in mounting.

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YOUR COST, each **39c**
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Trap consists of two slug-tuned silverized coils and two ceramic condensers. Mounted on a cadmium plated bracket, conveniently drilled and ready for mounting.

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BT CUT 1000 KC. CRYSTAL

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SP-105	725-0-725V @ 60 ma., 5V @ 3A., 6.3V @ 1.2A.	2.95
511-T2*	350V CT @ 150 ma., 6.3V @ 6A	2.10
475-T301*	245-0-245V @ 70 ma., 6.3V @ 6.2A., 1600V ins.	2.75
466-T1R*	110-0-110 @ 225 ma., 5V @ 3A	3.25
PC-110*	600V CT @ 125 ma., 6.3V @ 3.8A., 5V @ 3A., 1600V ins.	2.85

PLATE TRANSFORMERS

T-47168*	540-0-540V @ 650 ma.	9.95
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T-47164*	6.4V @ 8A., 1600V ins.	2.49
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SP-100	24V @ 10A.	4.95
D161917*	6.3V @ 3A., 2.5V @ 2A.	1.95
510-T4*	6.4V @ 10A., 6.3V @ 5A., 1200V ins.	2.95
475-T201*	5V CT @ 15A., 1600V ins.	2.75

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	Cap.	Current	Res.	Insul.	
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475-CH301*	3.8	75 ma.	160	1600V	4.15
475-CH302*	10	300 ma.	100	7500V	5.25
140010*	15	200 ma.	150	2000V	5.25
15406*	12	225 ma.	200	.....	5.25
510-X2	15	200 ma.	145	.....	5.25
S-16886	2.5-24	50/400 ma.	53	10,000V	8.95
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The Raytheon Bantal Tube simplifies your tube stock without loss of sales. Eight fast-moving Bantals replace sixteen equivalent GT and metal types. A new and better tube at no extra cost! Ask your Raytheon Distributor for Raytheon Bantal Tubes.

ELECTRONIC TUBE EXCHANGE

IN STOCK—1000 Klystron
5000 Magnetron

WE BUY ..... ***WE SELL***

Ask for List.

1A3	$ 0.29	5D21	$27.50	217C	$ 8.95	450TH	$17.50
1822	3.95	5MP1	2.95	250TH	22.50	527	7.50
1824	4.95	6J4	4.95	304TH	3.00	575A	12.50
1838	34.50	6C21	19.95	307A	3.95	703A	1.80
1N23	.79	7BP7	4.95	350B	1.80	714AY	4.00
2C40	3.95	15R	.45	371B	.75	715A	6.00
2C44	.86	100TH	10.50	388A	1.80	715C	25.00
2D21	1.08	211	.45	417A	19.00	723A	7.95
2J28	7.50					723A/B	9.95
2J27	8.95					725A	8.95
2J31	9.50					730A	5.95
2J32	12.50					802	4.20
2J49	36.00						
2J61	45.00						
2J62	45.00						
3J31	45.00						
2K25	19.95						
2K28	25.00						
3C23	2.50						
4C35	19.95						

803	$ 4.50	931A	$ 2.69		
804	6.75	957	.15		
809	2.25	1629	.29		
810	6.45	2050	.75		
811	1.75	2051	.40		
813	6.75	8012A	1.25		
814	2.50	8013A	1.40		
833A	3.95	8025	3.50		
833A	32.50	9001	.55		
834	5.75	9002	.35		
837	1.25	9003	.55		
838	3.25	9004	.55		
849	29.95	9006	.24		
851	29.95	CSB	6.95		
861	29.95	C6A	6.95		
869B	29.95	WL468	6.95		
872A	1.80	RX21	2.50		
874	.69				
876	.75	Thousands Others			

LIBERTY ELECTRONICS, INC.

135 LIBERTY STREET NEW YORK 6, N Y

PHONE WORTH 4-8262

ASK FOR FREE CATALOG

Mr. H. B. Lackey of *Southern Bell T&T Co.*, who had served as interim president of the chapter, then gave a report of the AFCA national meeting held in Washington in the spring.

Southern California

The July meeting of the Southern California Chapter was addressed by Commander Fredrick Y. Smith, USNR. Commander Smith discussed some of the uses of photography in the Navy and showed films, made by units with which he had been associated, of the large rocket "Tiny Tim," and of the experiences of the carrier "Franklin." -30-

NEW YORK OBSERVES AMATEUR RADIO DAY

HONORING the services of ham radio in putting ability, time, and equipment at the disposal of the nation in peace and war emergencies, and for the contributions it has made to the development of radio, Mayor Wm. O'Dwyer of New York proclaimed Saturday, October 8, as Amateur Radio Day.

The announcement was made in conjunction with the A.R.R.L. Hudson Division Convention and Show to be held at the Ninth Regiment Armory in New York City on the 7th, 8th, and 9th of October, sponsored by the Amateur Radio Operators of the City of New York. Purpose of this convention and show is to further the interest of the younger generation in radio electronics, and amateur radio communications.

Mayor O'Dwyer's statement, in the form of a proclamation, called upon the citizenry to honor the men and women of the Amateur Radio Service for "unselfish devotion to a duty which they have voluntarily assumed, and for the invaluable aid they have rendered our country and its communities." -30-

SIMPLE FOCUS CORRECTION

By JACK NAJORK

SEVERAL makes of TV sets now on the market use focus coils which consist of a circular permanent magnet encasing a low-current coil. The magnet supplies most of the focusing force, and exact focus is obtained by varying the small amount of current flowing through the coil by means of a front panel control.

When setting up or servicing these receivers, it will sometimes be found that exact focus cannot be reached with the front panel control because the permanent magnet has too strong a field. While this can be corrected by replacing the focus coil assembly, a much simpler, temporary remedy consists of hanging several small pieces of steel, such as machine screws, nuts, etc., on the side of the magnet.

When this is done, care must be taken to be sure that the uniformity of focus is not disturbed, and it may be necessary to carefully distribute the external correction. On the other hand, non-uniform focus over the face of the picture tube can sometimes be corrected by this means. In such cases, the exact location of the correction should be determined experimentally while observing the trace lines on the picture tube screen. -30-

OUTSTANDING VALUES NOW AVAILABLE

CLARK 15 WATT AMPLIFIER KIT

Another popular Clark kit. All first line parts to make an exceptionally fine unit.

• 6 tubes—2—6SQ7, 2—6V6, 1—6SN7, 1—5Y3GT. • Mike and phono input. • Separate treble and bass controls. • Heavy steel chassis and cover. • Frequency response 30-17000 CPS+1DB. • Output impedances 4-8-16-500. • Hum level 65 DB below rated output. **$18.95**

POWER TRANSFORMER

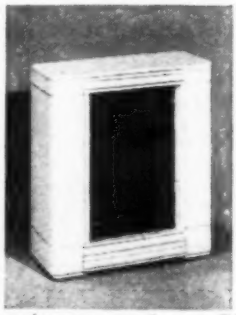
Heavy Duty Power Transformer—Ideal for heavy duty amplifier or small transmitter. Primary 115 volts. Secondary:

6.3 V 10 amps
6.3 V 6 amps
5V CT 3 amps
850 V CT 142 ma
Bias 65 V 142 ma

Terminal board type connections, upright mounting.

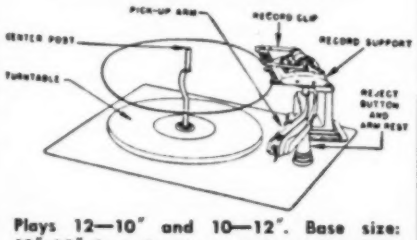
PRICE NOW **$3.95**

12" SPEAKER BAFFLE



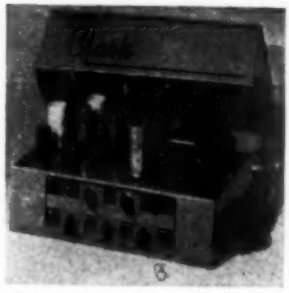
Beautifully styled floor type cabinet. Constructed of heavy section wood, for finest sound reproduction. High finish in mahogany or ivory. Dimensions 26"x 24½"x10¼". A real Radio Parts Co. special! **$8.95**

SPECIAL ON RECORD CHANGER! CRESCENT



Plays 12—10" and 10—12". Base size: 12"x15". Smooth action. A fine replacement changer..... **Only $11.95**

SUPER 25 WATT HI-FI AMPLIFIER KIT



Including all parts, schematic and layout diagrams, enabling you to easily build this fine, deluxe amplifier.

FEATURES:

- **Ready punched chassis**
- **Multi-impedance output transformer 2-4-8-16-500 ohms for use with any PM speaker**
- **2 mike inputs, 1 phono input**
- **Push pull phase inverter driver for low hum and distortion**
- **Hum level 65 DB below rated output.**
- **Separate bass and treble control**
- **110-120 volt AC operation, on fuse UL approved line cord**
- **6 tubes: 2—6SJ7, 6SC7, 2—6L6G, 5Y3**
- **Attractive, well-constructed steel chassis and cover. Baked hammerloid finish**
- **Indirect lighted panel**
- **Frequency Response 20-17000**

Nowhere can an amplifier of comparable features be had for twice the price. This amplifier, designed from the famous Clark Amplifier, will fill 90% of all sound uses.

$24.95 **COMPLETE WITH TUBES**

MICAMOLD TRANSMITTER KIT

No coils to plug in, switch to the 20, 40 or 80 meter bands. Uses a 6AG7 in an electron coupled crystal oscillator circuit. Very stable signal output. Pinetwork will match any antenna system. Requires 1 each: 83, 6AG7, 1614/6L6, a crystal and key. 11"x5¼"x 7½" high built up. Grey Enamel.....Only **$14.95**

150 WATT SOLDERING IRON

⅜" plug-in type tip. Removed by se. screw. Perfect for general soldering work. Handle stays cool. UL approved cord. Price..... **$2.29**

10 WATT AMPLIFIER SYSTEM

An amazing value! Including: •10 watt high quality amplifier. Tubes: 6L6, 5Y3, 6SL7. Mike and phono input. Attractive maroon and grey, all-steel cabinet. •Hi-Gain crystal mike with table stand. •Attractive heavy-duty carrying case •Heavymagnet Alnico V, speaker, with matching transformer.

This amplifier system is just the thing for all medium and small gatherings. It gives excellent performance on music and speech.

Only **$29.95** Complete

Amplifier alone **$15.95**

MICAMOLD ELECTROLYTIC CONDENSERS

Check these Premier Values—All Guaranteed!

	Each	Lots of 10
5 mfd—50V.....	$0.17	$1.50
10 mfd—10V.....	.17	1.50
10 mfd—25V.....	.17	1.50
20 mfd—25V.....	.17	1.50
40 mfd—150V.....	.32	2.90
20x20 mfd—150V.....	.35	3.30
20x30 mfd—150V.....	.35	3.30
30x30 mfd—150V.....	.35	3.30
50x30 mfd—150V.....	.39	3.60
25x25 mfd—150V, 200 mfd 35V.....	.39	3.60
30x30 mfd—150V—20/25	.39	3.60
40x40x40 mfd—150V.....	.39	3.60
40x20x20 mfd—350V.....	.39	3.60
8x8 mfd—450V.....	.39	3.60
16 mfd—450V.....	.39	3.60

P.M. SPEAKERS

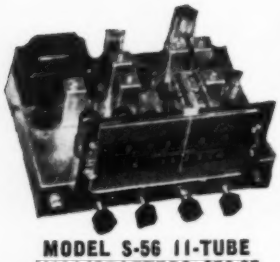
All Alnico V—All First Line Speakers.

FULLY GUARANTEED

3" P.M.	Square Frame.....	$0.79
4" P.M.	Square Frame.....	.95
5" P.M.	Round Frame.....	.95
6" P.M.	Round Frame.....	1.39
6" P.M.	Pin Cushion Frame.....	1.49
8" P.M.	Round Frame.....	2.29
10" P.M.	Round Frame.....	3.49
12" P.M.	Round Frame.....	4.59

WRITE FOR OUR LATEST CATALOG

Radio Parts Company, 614 RANDOLPH ST., CHICAGO 6, ILL.



hallicrafters!

$110.00 VALUE 11 TUBE FM-AM CHASSIS FOR $59.95

MODEL S-56 11-TUBE HALLICRAFTERS $59.95

★ WIDE RANGE AUDIO ★ A.F.C. ON F.M. ★ PHONO INPUT ★ FINEST CONSTRUCTION

Model S-56 Hallicrafters, high fidelity, 11 tube AM-FM radio receiver chassis for broadcast and FM 88 to 108 mc. Automatic frequency control on FM, holds the receiver in perfect tune. Phono connection on rear of chassis. Full range tone control with base boost. Push-pull 6K6 tubes in audio system. Frequency response essentially flat, from 50 to 14,000 CPS. Wide vision accurately calibrated slide rule dial, with pre-selection on broadcast band. Output transformer matches 500 ohm line. 4 antenna terminals; two for AM and two for FM. This is the finest type home radio that we know of today. Better get your order in early. Designed to be used in commercial radios selling in the **$400.00 to $600.00** class. The regular dealers net on this chassis is **$110.00.** However, lucky purchase enables us to offer these brand new, factory cartoned S-56 Hallicrafter chassis, complete with tubes and operation instructions, at only **$59.95,** less speaker. Speaker matching transformer 500 ohm to voice coil **$2.50** extra. Chassis size 12⅜" x10" x7¾". Weight 25 lbs. Brand new factory cartoned. Buy your S-56's with a wide range PM speaker. Pick your combination from the prices listed below and save.

S-56 WITH 12" 21 OZ P.M. $74.95

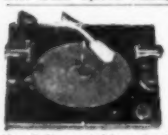
Hallicrafters S-56 chassis with tubes, 500 ohm to speaker matching transformer and our model A-50 super heavy duty 12-inch 21-oz. Alnico V PM speaker (regular $50.00 list). This gives you the complete radio for custom installations. Shipping weight 38 lbs. Stock No. S-56A50: A-50 Speaker S-56 and transformer all for **$74.95.** G.I. Dual Speed Changer. Stock No. GI-73: **$17.95.**

S-56 WITH 12" COAXIAL P.M. $71.95

Hallicrafters S-56 chassis with tubes, 500 ohm to speaker matching transformer and our model CR-13X 12-inch coaxial PM wide range speaker. This gives you a complete radio for custom installations. Shipping weight 33 lbs. Stock No. S-56CR13X: CR-13X speaker S-56 and transformer all for **$71.95.** G.I. Dual Speed Changer. Stock No. GI-73: **$17.95.**

S-56 WITH 15" JENSEN P.M. $79.95

Hallicrafters S-56 chassis with tubes, 500 ohm to speaker matching transformer and model A-15 PM Jensen 15-inch 6-lb. magnet speaker. This gives you a complete radio for custom installations. Shipping weight 47 lbs. Stock No. S-56A15PM: Jensen Speaker S-56 and transformer all for **$79.95.** G.I. Dual Speed Changer. Stock No. GI-73: **$17.95.**



CAPEHART CHANGER SCOOP $9.95

While 500 famous Capehart, 2 post automatic record changers last, we offer them to you for only $9.95. Plays standard 78 RPM records automatically: either 12 10" or 10 12". These changers are new and guaranteed O.K. except they have been removed from new sets, to be replaced with two-speed changers. They may require minor adjustment. This super heavy duty changer is equipped with a new type high fidelity, true-timbre, transparent crystal cartridge, with permanent needle. Requires same gain as the G.E. variable reluctance cartridge. Base size 14¼"x14¼". Stock No. 71-WL, with connecting instructions. Weight 23 lbs. Net Price **$9.95** each, 2 for **$19.00.** Extra tone arm with Astatic MLP-1 cartridge and needle **$1.00** extra. Extra tone arm with General Electric RPX-010 variable reluctance cartridge, **$2.95** extra.

G.I. DUAL SPEED CHANGER WHEN PURCHASED WITH S-56 OR S-59 $17.95

General Instrument Dual speed automatic record changer plays 10—12" or 12—10" 33⅓ or 78 RPM records automatically. Latest model with astatic reversible cartridge and Permanent needle. While our stock lasts we offer this changer, Stock #GI-73 for only **$17.95** when purchased with S-56 or S-59 Hallicrafters or **$19.95** when purchased by itself. Weight 11 lbs.

CRESCENT 350-A $12.95

Crescent Model 350-A, 78 RPM changer. Size 11½x13½. New factory cartoned. Net price **$12.95.** 2 for **$25.00.** Leatherette base **$1.98** extra.

AERO-STEWART WARNER $12.95

Aero-Stewart Warner, 78 RPM changer. Size 12x13", with permanent needle. New factory cartoned. Net price **$12.95.** 2 for **$25.00.** Leatherette base **$1.95** extra.

FARNSWORTH 3 POST $14.95

Farnsworth, 3 post, 78 RPM changer. Size 12½x13½" with Caltron VR cartridge and needle. Net price **$14.95.** Leatherette base **$1.95** extra.

WEBSTER CHICAGO 77-1 NET $17.88

WEBSTER CHICAGO MODEL 356 NET $33.51

Webster Chicago, Model 356 3-Speed Automatic Record Changer. Plays all records automatically. Tendon Tip needle with quick change lever. This is the finest 3-Speed Changer on the market. Net **$33.51.** Webster Chicago 77-1. Plays 7" records either 33⅓ or 45 RPM automatically. Base size 10⅛ x 7 5/16 x3¼ above and 3 5/16 below. Net **$17.88.** Spiders for RCA records 10 for **25c.** VM 406 Tri O Matic. Plays all records 33⅓, 78 and 45 RPM. Base size 14 x 12¼ x 7¼. 2 Reversible crystal cartridge. Net **$33.90.** VM 406-GE with GE Variable Reluctance Cartridge and heads. Net **$37.90.**

WALNUT ARM CHAIR CABINET $29.95

Walnut armchair cabinet size 24x16x27. Radio compartment space 14x9x10". Changer compartment 14" square, hinged lid covers changer. Walnut armchair cabinet with blank panel stock No. AR-15 net **$29.95.**

Blond armchair cabinet stock No. BAR-151 net **$34.95.** Either blond or walnut cabinet may be ordered specially cut for S-56 Hallicrafter. Specify (cut for Hallicrafters).

REGULAR $15.00 ELECTRIC CLOCK ONLY $4.95

Beautiful Elexa self-starting electric clock, with heavy bronze case and unbreakable plastic front. Gold numerals and sweep second hand. Size 6 x 5½ x 2¼". This is a beautiful clock. By looking at it you could tell it was at least a $15.00 clock. If you want a really nice Christmas present for someone, buy this. While our limited stock lasts. **$4.95** each. Shipping weight 4 lbs. Stock No. EX-1. Net **$4.95.**

6-TUBE AC 2 BAND RADIO KIT $9.95

BIGGEST RADIO KIT VALUE IN U. S.

BUILD A RADIO WITH MATCHED "DETROLA" PARTS

A complete kit of parts, tubes and ready punched chassis to build a fine 6 tube power transformer type radio chassis. (No cabinet.) We furnish every piece as well as a printed diagram and photograph. Chassis size 14 x 7½ x 7. Receives standard broadcast and 6 to 18 MC foreign short wave. 3 gang tuning condenser used on both bands. 90 mil power transformer 6v6 output tube. This kit is made up of parts intended for use in a high quality Detrola radio. Has full lighted slide rule dial. Everything goes together just like a factory built radio. Priced complete with 6 tubes. Kit model 6-ACX. Less speaker. Weight 16 lbs. Net **$9.95.**

CHOICE OF EITHER 8 OR 10 INCH DYNAMIC SPEAKER **$1.99** EXTRA

MCGEE'S NEW FM-AM-PA KIT $39.95

12 Tube Kit Model PRK-51. This is the most elaborate radio, P.A. kit that our engineering department could design. Here are its features: Receives broadcast, 550 to 1650 kc and FM, 88 to 108 mc (3 gang tuning on FM.) The audio system is wide range, 40 to 17,000 cps., 5 lb. interwound high fidelity output matches 8 ohm speaker. Twin tone controls, (bass and treble boost). Phonograph inputs for standard crystal or General Electric variable reluctance. Mike input for crystal or dynamic mike. This radio may be used for an 18 watt P.A. system, a recording amplifier, or for a high fidelity F. M. sound system. Chassis size, 15½ x 7½ x 7½". ready punched. Everything furnished with the kit, including tubes; 6AG5, 6SB7Y, 2—6BA6, 6AT6, 6H6, 6BE6, 2—12AT7, 2—6V6 and 5Y3. The FM RF section is ready wired (coils and sockets), to make this kit easier for you to build. 6" slide rule dial. Complete kit model PRK-51, with photos and instructions, **$39.95.** Speaker recommended, Oxford 12", 22 oz. PM, curved cone and 1½" voice coil. Model 12-XMS **$10.00** extra.

New 3-Way PORTABLE RADIO KIT ONLY $12.95

Sensational new 3-way portable radio kit. 4 tubes plus rectifier. Housed in an all aluminum, leatherette covered case made by Farnsworth, with loop antenna built-in. Size 5x9x6". Build yourself a professional looking radio with this kit. Every piece furnished including tubes: 1R5, 1T4, 1S5, and 3V4, as well as easy-to-follow diagram and photo. This set will make a full two gang superhet, that looks like a $40.00 radio. We should ask $17.00 for this kit. Stock No. FP-4X, complete kit less batteries, weight 8 lbs. Net price **$12.95.** Kit of batteries, 67½ volt "B" and "A", **$2.25** extra.

ONLY $9.95 BUYS A 6-TUBE RADIO KIT

6 tube superhet, broadcast AC-DC kit. Using full size tubes. Housed in a Farnsworth plastic cabinet, with slide rule dial, R.F stage, 2 gang condenser, loop antenna and 5" speaker. This makes a factory like radio. The radium chassis is ready punched and sockets are installed. This type of kit usually sells for at least $15.00. All parts furnished, including tubes: 12K8, 2—12SK7, 12SR7, 35L6 and 35Z5. Complete with diagrams and photos. Kit model FS-6. Wt. 8 lbs. **$9.95.**

34-WATT WIDE RANGE AMP-KIT $29.95

It's the newest thing in audio amplifiers. McGee's wide range, 34 watt amplifier kit with inputs for crystal or dynamic mikes and any crystal phono cartridge, as well as the new G.E. variable reluctance cartridge. Output transformer is wax impregnated, weighs 6 lbs. Voice coil taps 4-8-15-250 and 500 ohms. Push-pull 6L6 output tubes. Separate electronic base and treble boost. Inverse feedback. Input tube filament is DC heated to reduce hum level to nil. Frequency response from 20 to 20,000 cps. Easy to follow diagram and photos for easy assembly of this kit. Ready punched chassis. Every part furnished, including tubes: 2—6L6, 5V4, 3—12AX7. Shipping weight 25 lbs. Stock No. XX-34, net **$29.95.** Model XX-34WT Amplifier is Kit Model XX-34 wired, ready to operate, net **$39.95.**

Kit Model TF-4 **$6.95**

4-TUBE RADIO KIT $6.95

Complete Radio Kit Model TF-4. A 4 Tube AC-DC Broadcast TRF Receiver. Ideal for the beginner. 2 Gang Condenser. Ready punched chassis, Alnico V PM Speaker Airplane Dial. Plastic cabinet. Diagram photos and special pictorial diagram for beginners. This is the simplest type radio to wire. Price includes every part and tubes, 12SK7, 12SJ7, 50B5 and 35W4. Kit Model TF-4. Weight 6 lbs. Net **$6.95.**

33X Crystal Mike with 20 ft. of cable, fall sale price **$10.95.**

33D Dynamic Mike with 20 ft. of cable, fall sale price **$12.95.**

708A—CX50 Shure Crystal with cable **$9.95.**

Belden Mike Cable, 30 ft. coil for **$3.00.**

SUPER DELUXE 30-WATT AMP. KIT $19.95

A complete kit of parts to build a 30 watt public address amplifier. Ready punched chassis with cover. 160 mill power transformer for 110 watt AC. Inputs for two mikes and crystal or G.E. Variable reluctance phono-pick up. Base boost tone control, heavy duty shielded output transformer matches 4 or 8 ohm voice coils. Inverse feed back. Everything furnished including easy to follow diagram and tubes: 2—6SJ7, 2—7N7, 2—6L6, 5V4. This kit makes a ready saleable amplifier, of commercial quality and appearance. Kit TM-30 weight 25 lbs. Net. **$19.95.** With 34 watt wide range high fidelity (20 to 20,000 cps) compound filled output transformer with windings 4-8-250-500 ohm add **$5.00.**

COMPLETE AMPLIFIER KITS—WITH MIKE-PHONO AND V.R. INPUTS

5 WATT KIT TM-4

8 WATT KIT TM-8

12 WATT KIT

20 WATT KIT

Kit Model TM-4, 5 Watt Amplifier Kit. Ideal for beginner construction. Has features of higher priced amplifiers. Inputs for phono pick up or mike. Compensation for the G.E. Variable Reluctance pick up. Push pull output gives good tone quality. Output to 8 ohm Voice Coil. Variable tone control and fader control. Ready punched chassis. This makes a top quality AC-DC Audio Amplifier. Priced complete with tubes, diagram and photos. 2—50B5, 2—12AX7, plus selenium rectifier. Weight 3 lbs. Stock No. TM-4, **$6.95.** Crystal Mike and utility desk stand **$4.95** extra. Model TM-4WT Amplifier is TM-4 kit wired ready to operate, net **$9.95.**

Kit Model TM-8. 8 Watt Amplifier Kit for utility use, record playing, or paging. Matched component parts. Ready punched chassis. Variable tone control. One Control fades from mike to phono. Input compensation for G.E. Variable Reluctance pick up. Output matches 8 ohm Voice Coil. 75 Mill Power Transformer. Price includes tubes, diagram and photo. Push pull 6AQ5, two 12AX7, plus rectifier. Kit Model TM-8. Weight 8 lbs. Net **$8.95.** Crystal mike and utility desk stand **$4.95** extra. Model TM-8WT amplifier is TM-8 kit wired ready to operate, net **$11.95.**

12 WATT KIT

Kit Model TM-12. 12 Watt Amplifier kit. Ideal for a high quality record player, as a P.A. system or recording amplifier. Matched component parts, ready punched chassis. One control fades from phono to mike. Input compensation for G.E. Variable Reluctance pick up. Output matches 8 ohm Voice Coil. 100 Mill Power Transformer. Complete with tubes, diagram and photos. 2—6V6, 2—12AX7, and rectifier. Variable tone Control. Model TM-12, weight 10 lbs. Net **$10.95.** Crystal utility mike and desk stand **$4.95** extra. Model TM-12WT amplifier is TM-12 kit wired ready to operate, net **$14.95.**

20 WATT KIT

Kit Model TM-20. A high quality 20 Watt Audio Amplifier with 135 Mill Power Transformer and push pull 6L6's. Inputs for mike or phono pick up. Compensation for G.E. Variable Reluctance pick up. Tone and fader controls. Has heavy duty universal output transformer to match one or two speakers. Ready punched chassis. Price includes tubes, diagram and photos. 2—6L6, 2—7N7, 7Z4. Frequency response 50 to 9,000 cps. Kit Model TM-20. Weight 20 lbs. Net **$15.95.** Model TM-20WT amplifier is TM-20 kit wired ready to operate, net **$20.95.**

Stock No. 6-110KR, net **$14.95.** 6-110KR-WT power supply ready to operate, **$22.95.** 6-110 Volt Power Transformer only **$6.95.** Heavy duty 60 cycle Vibrator only **$1.95.**

New utility power supply kit convert and amplifier up to 30 Watts and 110 Volt-6VDC operation. Also furnish 110 Volt 60 cycle to run phono motor. Complete kit with tubes and diagram. Weight 20 lbs.

Miniature Broadcast Station Kit $6.95

Kit Model DE-6X. Build your own 110 Volt AC-DC 4 tube miniature radio station—800 to 1500 KC. Broadcast from crystal mike or phono record. (Warning this transmitter must be used with only a short aerial otherwise you will transmit 2 or 3 miles.) Complete kit including tubes, diagram and instructions. Weight 4 lbs., net **$6.95.** **Model DE-6XWT** Miniature transmitter ready to operate **$8.95.** Crystal mike and desk stand **$4.95** extra.

McGEE RADIO COMPANY

PRICES F.O.B. K.C. Send 25% Deposit with order. Bal. Sent C.O.D. With parcel post orders include postage.

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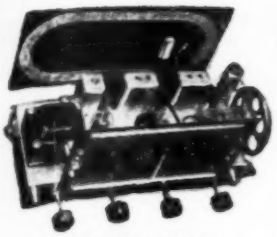


S-59 8-TUBE FM/AM CHASSIS $32.95

8 TUBE S-59 AM/FM HALLICRAFTERS-CHASSIS $32.95

REGULAR $50.00 DEALERS NET

PUSH-PULL WIDE RANGE AUDIO

WHY BUY AN ORDINARY RADIO

WHEN YOU CAN BUY A HALLICRAFTERS S-59

Model S-59 Hallicrafters, high fidelity, 8 tube FM/AM chassis, for custom installations. Receives broadcast 540 to 1700 KC and FM—88 to 108 Mc. Size 12¼x7½x9". An excellently engineered chassis, with accurately calibrated slide rule dial. Variable tone control and 60 to 14,000 cps, wide range audio. (Push-pull 6K6) 8 ohm output transformer will match most PM speakers. No special output transformer required. Loop antenna built on, for broadcast reception. This is without a doubt the most radio chassis value we have ever been able to offer. Better rush your order in now. We have them. Heavy duty 6x9" PM speaker, for use with the blond console, pictured on the right, $2.95 extra.

S-59 8 tube FM/AM chassis, with tubes. Wt. 16 lbs. ..... Net **$32.95**

S-59 8 tube FM/AM chassis, with tubes and regular $12.95 12" coaxial PM speaker, CR-13X. Wt. 24 lbs. Net **$42.95**

IDEAL FOR S-59

CABINET FOR S-59 $19.95

Beautiful blond console cabinet. Size 17 x 21 x 33" high. This cabinet was intended for use on a nationally known $129.00 radio-phono combination. The lower half of the cabinet is divided for albums. The upper half has a hinged lid, which covers the radio and changer. Radio panel is 8 x 15" and may be ordered ready cut for Hallicrafters S-59 or with a blank panel for installing your own chassis. Changer panel is blank, will hold a changer up to 12x15". Cabinet will hold a 6" or a 6 x 9" speaker. Shipping wt. 40 lbs. Stock No. JB-4 blond cabinet, ready cut for the S-59 Hallicrafters. (Will not hold S-56) **$19.95**

6 x 9" 4.64 Alnico V PM speaker **$2.95** extra

Stock No. JB-5X same but blank radio panel **$19.95**

Stock No. B-1000 cabinet just as we bought them. You re-do the radio and changer area to suit your own need. Changer area is now 15 x 15" and radio area 5 x 15 x 11½". Stock No. B-1000. Shipping weight 40 lbs. **$14.95**

ST. GEORGE WIRE RECORDING MECHANISM $22.95

St. George wire recorder mechanisms. Brand new, complete wire recording and playback mechanism. (Also plays 78 RPM records when crystal pick-up is installed.) Records and plays back up to 1 hour on standard Webster wire. Furnished with diagram for 3-tube converter (adapts radio or amplifier for wire recording). X-93 St. George mechanism, weight 15 lbs. Requires 9x13x3½" space. Net, **$22.95.** Crystal pick-up for playing and recording phono records, **$1.95** extra. Webster wire, 1 hour, **$3.25**; 30 min., **$1.95**; 15 min., **$1.30.** Crystal mike and desk stand, **$4.95** extra.

WIRE RECORDER CONVERTER $12.95

With this 3-tube converter you can adapt the St. George Airking, or Webster Chicago wire recorder mechanism to any radio or P. A. system. Only 3 connections necessary. Just plug in to the phono input of your amplifier and connect to plate of output tube. AC-Transformer construction, gain for mike, 3 position switch for quickly changing from record to play-back. Priced ready wired and tested with instructions and tube 12AT7 pre-amplifier; 6AQ5 Oscillator erase; 6X4 rectifier. Stock No. RR-Y, net. **$12.95.**

PORTABLE RECORD PLAYER KIT $9.95

Deluxe Portable Record Player Kit housed in the attractive Capitol case. Includes all parts and easy to follow diagram. Has 4" Heavy Duty PM Speaker. 78 RPM Phono Motor. All necessary parts to build a 70L7 type Amplifier. Weight 14 lbs. Model CK-1, Net **$9.95.**

WIRE RECORDER and 18-WATT P.A. SYSTEM

SALE PRICE **$69.95**

Three years of wire recording experience has lead us to the development of this combination wire recorder and public address system. Housed in an attractive portable case with hinged lid on the recorder compartment. Beautiful streamlined plastic grill. Storage compartment in back panel for mike and accessories. Size 21x11x14. A full 18 watt HI FI amphifier with P.P. 6V6 tubes in output stage and separate 6AQ5 eraser circuit. This new super erase circuit eliminates all the bugs in wire recording. 12-inch Alnico V, P.M. speaker. Extension speaker jack. Mike input, tone control. Equipped with the St. George wire recorder playback mechanism that has 78 rpm turntable and General Electric Variable reluctance pick-up. You can record or play phono records. Record from mike. The play-back quality is tops. Plenty of volume and good fidelity. This is also a top wire recorder. Unit is completely assembled and ready to operate. Furnished with 15 minute spool of Webster recording wire. Extra recording wire, 15 min., **$2.30**; 30 min., **$1.95**; hour, **$2.25.** **Model 6E-16** Portable public address system and wire recorder shipping weight 38 lbs. Net. **$69.95.**

Crystal Mike and Desk Stand, **$4.95** extra.

30 MIN. RECORDING WIRE SCOOP PRICE $1.49

Manufacturer's stock of recording wire, on metal spool, OK for Webster, Air King, etc. 30 min. spool Stock No. 30WS, net **$1.79**; 10 for **$16.95.** Empty metal spools, **25c** each; 10 for **$2.19.**

100 watt Belden Soldering Iron. A $3.00 value, **$1.79**; 3 for **$5.00.**

1 HOUR TAPE RECORDER MECHANISM $59.95

TAPE RECORDER 1 HOUR MECHANISM TWIN CHANNELS SPECIAL $59.95

Our leader tape recorder mechanism—Size 10¼x13⅜x7-5/16, weight 16 lbs. Tape speed full 7½ feet per second—two sound channels. One hour with 7" reel, 30 minutes with 5" reel. Bias frequency to erase 50K.C. Twin erase heads, one recording head. Response flat from 60 to 8,000 cps. Non-slip and Wow-less drive. Made for high fidelity recording and play-back on tape. Furnished complete with suggested diagram and erase coil. Model TP4-K Tape recorder mechanism, sale price, **$59.95.** Recording Tape 7" Reel, **$2.50.**

AMPLIFIER KIT FOR TAPE RECORDING $19.95

Tape recorder, playback amplifier Kit Model TPR-10. All parts, punched chassis pan, tubes, photos and diagram furnished. When wired will make a tape recorder and playback amplifier of good quality. Inputs for crystal or dynamic mike and phono pick-up. (May be connected to the detector of any radio set to record radio programs.) Output transformer matches any 8 ohm speaker. Tone control. Complete with tubes: 2-6SF5, 7F7, 7N7, 2—6V6, and 6X5. Shipping weight 20 lbs. Stock No. TPR-10, Net **$19.95.**

MUSICAL P.A. 34-WATT $54.95

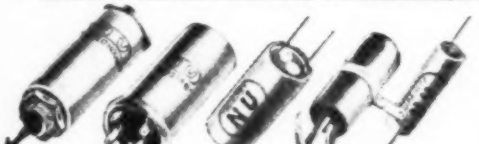
McGee's wide range musical P.A. amplifier, **$54.95.** Powerful 34 watt, wide range amplifier, housed in an attractive leatherette covered cabinet, with tri-color plastic front. 12" super heavy-duty Oxford curvelenter cone, 22 oz. Alnico V PM speaker. This speaker is used by others only on their highest priced amplifiers. Response from 40 to 17,000 cps. 3 inputs, 2 for musical instruments or mikes, one for crystal pick-up. Tone compensation for G.E. variable reluctance pick-up. Push-pull 6L6 output tubes, twin tone controls and inverse feedback. This amplifier may be used for two instruments or two mikes. It is the most versatile amplifier that we know of. Stock No. MM-35, complete ready to operate. Weight 26 lbs. Net price, **$54.95.**

18-WATT AMP KIT FOR INSTRUMENTS MIKES OR PICKUP $14.95

General purpose portable amplifier kit, housed in an attractive portable case, with 10" speaker. Two inputs for instruments or mike, one phono input. Variable tone control. Kit is complete with diagrams and photos and tubes: 2—12AX7, 6X4, 2—6AQ5. AC transformer type. Stock No. MM-18RC, weight 20 lbs. Net **$14.95.** Crystal mike and desk stand, **$4.95** extra.

100 ASSORTED RESISTORS $1.29

¼ and ½ watt carbon resistors all insulated and color coded, popular sizes.



NATIONAL UNION CLOSE-OUT SALE

6C TT AT CT T

ORDER $100.00 WORTH—TAKE 10% OFF ON N.U. COND.

TYPE "AT" N.U. TUBULAR ELEC. ALUMINUM WITH SEALED ENDS

National Union Type AT Electrolytics. Housed in sealed metal tubes in spun-end cardboard sleeves. Bare wire leads. Standard package of 10 condensers. Save over half. This is your every day need in condensers. One-year guarantee.

National Union Aluminum Tubulars, with paper insulating sleeves. Type AT

10 MFD. 25v. .15c	24 MFD. 150v. .30c	4 MFD. 450v. .20c	20-20 150v. .30c
25 MFD. 25v. .20c	30 MFD. 150v. .35c	8 MFD. 450v. .30c	40-20 150v. .35c
100 MFD. 25v. .25c	80 MFD. 150v. .35c	16 MFD. 450v. .40c	50-30 150v. .50c
8 MFD. 150v. .15c	8x 8 450v. .40c	30 MFD. 450v. .50c	80-40 150v. .60c
16 MFD. 150v. .25c	16x16 450v. .50c	8x8 150v. .20c	20-20 450v. .60c

NATIONAL UNION ALUMINUM CAN "TWIST TAB" TYPE TT

National Union Type TT Electrolytic Condensers. Aluminum can F.P. type Twist Tab mounting common negative grounded to can. Individually cartoned in green N.U. boxes. Each condenser supplied with 1 bakelite insulating plate and 1 metal grounding plate. Save over half on these. All sizes and one-year guarantee.

100 MFD 25v. .19c	20-20 MFD 150v. .30c	40-40, 150v, 25 MFD 25v. . . .40c
500 MFD 25v. .19c	40-40 MFD 150v. .35c	40-40-20 MFD 150v. 60c
10 MFD 450v. .25c	40-40 MFD 150v. .40c	40-40-40 MFD 150v. 60c
20 MFD 450v. .30c	50-50 MFD 150v. .50c	80-40, 150v, 25 MFD 25v. . .60c
30 MFD 450v. .40c	80-40 MFD 150v. .60c	10-10, 450v, 20 MFD 25v. . .50c
40 MFD 450v. .50c	16-16 MFD 450v. .45c	10-10-10, 450v, 20-25v. 70c
80 MFD 450v. .60c	40-40 MFD 450v. .60c	10-10-10-10, 450v 70c
	20-20-20 450v. .65c	
	20-20-150v, 100 MFD 25v. .45c	

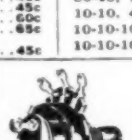
N.U. THREAD MOUNT ALUMINUM CAN TYPE SC

National Union Type SC-SCN-SCS Upright Aluminum Can Condensers. With pal nut mounting. Flexible insulated leads. Individually cartoned in green N.U. boxes. Save over half on this. One-year guarantee.

4 MFD 450v. .25c	8 MFD 600v. .60c
8 MFD 450v. .30c	16 MFD 600v. .80c
16 MFD 450v. .35c	8 MFD 525v. .50c
40 MFD 450v. .50c	8x 8 450v. .50c
4 MFD 600v. .35c	16x16 450v. .60c
	20x20 450v. .70c

100-600V. BY PASSES, $6.95 MAKE YOUR OWN ASSORTMENT

T .0001, T .00025, T .0005, T 001, T .002, T.005, T .006—5c Each.
T .02, T .03, T .04—6c Each.
T .05—7c Each; T .1—8c Each.
T .25—10½c Each: T .5—15c Each.



N.U. CONTROLS 100 FOR $25.25

Individually cartoned volume controls, all have off-on switch attached.

NU 5M-A	5,000 OHM	24c
NU 10M-B	10,000 OHM	24c
NU 25M-A	25,000 OHM	24c
NU 50M-B	50,000 OHM	29c
NU 100M-B	100,000 OHM	29c
NU 250M-TX	250,000 OHM Tapped	29c
NU 500M-TX	500,000 OHM Tapped	39c
NU 1 MEG-Tx	1 MEG OHM Tapped	39c
NU 2 MEG-TX	2 MEG OHM Tapped	39c
NU-500M-CB	500,000 OHM	39c

100 National Union Controls **$29.95.** Assorted as follows: 25 of the 1st 3 Types, 25 of the 2nd 3 Types, and 50 of the last 4 Types.

100 RADIO TUBES $29.95

250,000 Tubes for fast sale. Tremendous value. Tubes up to $3.00 list. 100 Cartoned and branded Hyvac Miniature Tubes for $29.95. Over a million sold. Guaranteed full replacement. 34c Each in smaller quantities.

1R5	12BE6	12AU6	6SU7	12S8			
1T4	12AT6	12BF6	6AQ5	9001			
1U5	35W4	6BA6	6AQ6	9002	6BA7		
3A4	35B5	6BE6	6C4	6BH6	6BJ6		
1S5	50B5	6AT6	6X4	117Z3	35C5		
3V4	12AT7	6AL5	6W4	19T8			
3Q4	12AU7	6AQ5	6AG5	6BJ6			
3S4	12AX7	6BF6	6AU6	6AT6			
12BA6	12BA7	6AU7	6T8				

$29.95 for 100 — 34c each

Popular GT Tubes, individually cartoned and branded Hyvacs. $35.00 per hundred. 39c Each in smaller quantities.

6V6	6X5	6SA7	12SF7	12SN7	32L7	39c each
6SN7	6SD7	6SQ7	6J5	12BF7	6BG6	
6C5	6Y3	25L6	6SJ7	6SL7	6SU7	100 for $35.00
6P5	6K7	70L7	12SJ7	35Z5		
12A8	6Y3	1B4	6SF5			
6S8	6K6	12K8	80			
12S8	6SA7	12A6				

HYVAC 6AK5 6SN7 6J6 59c EACH

STANDARD BRAND TUBES CARTONED and UNCARTONED 49c

0Z4G	1G6	5V4	6F7	6SA7	6T7	7B8	7S7	12F5	12SQ7	26	43	6BE6
1A4	1H6	5Y3	6H6	6SC7	6V6	7C4	7V7	12H6	12SR7	27	45Z5	50Y6
1A6	1J6	6A3	6J5	6SD7	6X5	7C5	7Y4	12J5	12Z3	30	50B5	41
1B4	1L4	6AB7	6J7	6SF5	6Y6	7C6	7Z4	12K8	14A7	32	56	35B5
1B5	1R5	6AC7	6K5	6SF7	6Z7	7C7	10Y	12Q7	14B6	33	57	3Q4
1C6	1S5	6AG7	6K6	6SG7	6ZY5	7E5	12A6	12SC7	14C7	34	58	14A4
1C7	1T4	6B8	6K7	6SH7	7A4	7E7	12A8	12SF5	14H7	35	70L7	12J7
1D5	1V	6C4	6K8	6SJ7	7A5	7F7	12AH7	12SF7	14Q7	35W4	75	6AT6
1D7	2A5	6C5	6L5	6SK7	7A6	7H7	12AT6	12SG7	14W7	35Y4	76	6BA6
1D8	2A6	6C6	6L7	6SL7	7A7	7L7	12BA6	12SH7	19	35Z4	77	
1F4	2A7	6D6	6N7	6SQ7	7B4	7N7	12BD6	12S17	25L6	35Z5	78	
1F5	3S4	6D8	6R7	6SR7	7B5	7Q7	12BE6	12SL7	25Z5	38	80	
1G4	5T4	6F5	6S7	6SS7	7B6	7W7	12C8	12SN7	25Z6	39		

NAME BRAND 1½ VOLT LOCTALS, ETC.

1LN5	1LD5	1LH4	1LC6	1LA6	1LB4	69c	10 for $6.50
1LC5	1LG5	3LF4	1LE3	1LA4			
1A7	1H5	1A5	1N5	3Q5	1T5	69c	
1Q5	1P5	1C5	1S4	1G6	117Z6	69c	

35A5 50A5 69c Each.

Standard Brand Tubes, fully guaranteed. New and perfect.

12SA7	59c	12SK7	59c
35L6	59c	50L6	59c

10 of any of these for **$5.50**

NUCLEAR "SNIFFER" GEIGER Counter $54.50

Nuclear "Sniffer," made by a leading manufacturer of nuclear instruments for locating radio-active materials. This small Geiger counter weighs only 2 lbs., powered by 2 standard flashlight batteries, . . . shed complete with light weight headphones ready to sniff out radio-active material. Stock No. ATO-1. Shipping weight 4 lbs. Net, **$54.50.**

PHILCO MIKE SALE BRAND NEW WITH 20 FT. OF CABLE

$9.95 605 — $14.95 630 — $14.95 VI

High imp. dynamic mike made for Philco 605, 20 ft. cable. Reg. **$26.00** list. Sale price **$9.95.** 3 for. **$26.95**

High imp. dynamic mike made for Philco 630, 20 ft. cable. Reg. **$36.50** list. Sale price **$14.95.** 3 for. **$41.95**

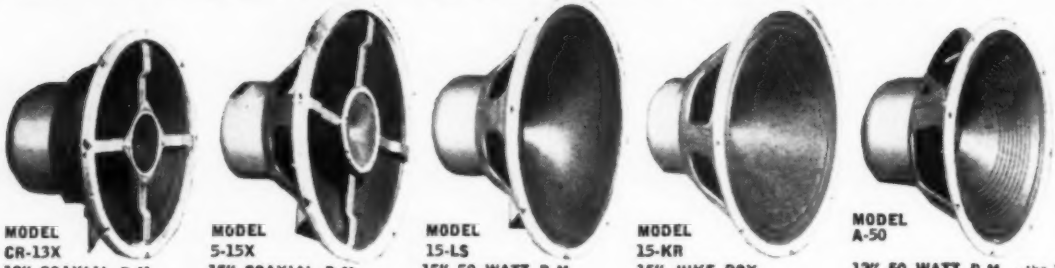
High imp. studio velocity. Made for Philco VI, 20 ft. cable. Reg. **$40.00** list. Sale price **$14.95.** 3 for. **$41.95**

McGEE RADIO COMPANY

Prices F.O.B. K.C. Send 25% Deposit with Order, Balance sent C.O.D. With Parcel Post Orders, Include Postage

TELEPHONE VICTOR 9045. WRITE FOR FLYER
1422 GRAND AVE., KANSAS CITY, MISSOURI

NATIONALLY FAMOUS 12" COAXIAL P. M. SPEAKER $12.95



MODEL CR-13X
12" COAXIAL P.M.
$12.95

MODEL 5-15X
15" COAXIAL P.M.
$24.95

MODEL 15-LS
15" 50 WATT P.M.
$16.95

MODEL 15-KR
15" JUKE BOX
$9.95

MODEL A-50
12" 50 WATT P.M.
$14.95

DELUXE 12" COAXIAL MODEL CR-13X — $12.95

- **RESPONSE 40 TO 17,000 C.P.S.**
- **FINE CONSTRUCTION**
- **GREY FINISH** • **REGULAR $32.50 LIST**

Newly designed by one of America's finest speaker builders. Made for FM and AM high fidelity radios and record players. This speaker is incorporated in radios of the 500 dollar bracket. It has an especially designed 12" 6.8 oz. Alnico V Magnet PM for the low range Woofer and a coaxially built in 3" Alnico V tweeter for the extended high range. The high pass filter is concealed under the pot cover. Just hook to any 8 Ohm output transformer. Will work in place of any home radio speaker as most speakers have an 8 Ohm Voice Coil; only 2 wires to connect. Will handle 18 Watts peak. Wide range response 40 to 17,000 Cycles. This speaker should sell for $35.00. Why buy any ordinary speaker when we offer a 12" Coaxial PM for only $12.95. Shipping weight 8 lbs. **Model CR-13X, $12.95. Two for.....$24.95**

15-INCH "COAXIAL" P.M. $24.95

- **REGULAR $62.50 LIST** • **FINEST CONSTRUCTION**
- **KING OF COAXIAL SPEAKERS** • **210Z ALNICO V**

"IT WOOFS AS IT TWEETS"

The King Coax. A 21.5 oz. 15 inch Alnico V PM speaker with a built-in high frequency tweeter. Will respond to from 40 to 17,000 cycles. This is a ruggedly built speaker with a curvelenier one piece molded cone. Built-in high pass filter. Just hook to any 8 ohm output. Built by the maker of our ever popular 12 inch coax model CR-13X. This speaker has a retail list of over $60.00. We offer you our 5-15X 15 inch coax for only **$24.95.** Shipping weight 16 lbs.

15" DELUXE 50-WATT P.M. SPEAKER — $16.95
WITH WIDE RANGE MOLDED CONE

Model 15-LS. 15" 21½ oz. Alnico V Magnet PM Speaker. Will take 35 watts with ease. Thousands of dollars were spent in building the fine tools to produce this speaker. The 8 ohm voice coil is 1½" in diameter and has been heat treated and plastic coated. Constructed to eliminate loose voice coils, wires and warping. **Made by** a renowned builder of fine speakers. Truly the King of juke box speakers. Shipping weight 14 lbs. Net Price **$16.95.** Two for.....$32.95

15" JUKE BOX P.M. SPEAKER $9.95

Model 15-KR—Pre-War or Post-War, you never bought a speaker like this for such a scoop price. Made by a nationally known builder of fine speakers. A full 15" 12½ oz. Alnico V magnet speaker of juke box quality. Has standard 8 ohm voice coil. Will take up to 18 watts average or 25 watts peak. Here is a speaker that will bring out those low notes. Latest 1948 production; not line through-outs. Every speaker is guaranteed new and perfect. We may not be able to continue this offer for long, so place your order now. Stock No. 15-KR. INCLUDE POSTAGE. Wt. 10 lbs. A **$35.00** value for only.....**$9.95**

50-WATT 12" SUPER HEAVY DUTY P.M. $14.95

Model A-50—12", 50 watt super heavy duty permanent magnet speaker. Has 1½" 8 ohm treated voice coil and one piece molded cone. Heavy half inch machined pot, with bolt secured 21 oz. Alnico V magnet. Frame is of heavy construction with metal pot cover. Finished in silver-grey enamel. This speaker is the best value possible today. Efficiency is two to three times that of ordinary speaker. Especially recommended for all public address systems and high quality home audio systems. Will handle 35 watts with ease and 50 watts peak or short lengths of time. Its retail value is $50.00. But, by our large purchase, we are able to offer it to you for only **$14.95.** Do not confuse this speaker with surplus merchandise. This is the latest production. Model A-50. Shipping weight 13 lbs. Net **$14.95.** 2 for.....**$29.00**

OUTPUT TRANSFORMER HIGH FIDELITY 20—20,000 C.P.S. SCOOP PRICE

$6.95 EACH

6600 OHMS PLATE TO PLATE

Why pay $20.00 or $30.00 for an output? Supreme quality and high fidelity output transformer. Designed to match push-pull plates (2—6L6, 2—6V6, or 2—6AQ5) class AB, to 4-8-15-250 and 500 ohm; with 10% feedback winding. Housed in a compound filled case: 3⅞x4½x3". Actual net weight, 6 lbs. If you want the best quality from your audio system, order this transformer. Response essentially flat from 20 to 20,000 cycles. We have tried several high fidelity outputs in our lab and find this to be the best value. Even though your amplifier only puts out 10 or 15 watts, this 34 watt job is what you should have. Connecting instructions are furnished. Stock No. A-403, shipping weight 8 lbs. Net price $6.95

40-Watt CAPEHART
Wide Range Output Trans. $7.95

Built for Capehart for this finest combination. 40 watt capacity all windings interwound to increase high frequency response and decrease capacity losses. High inductance in order to get efficiency at low audio frequency. This high fidelity output transformer is fully shielded and has a net weight of 6 lbs. Made to match push pull 6L6 tubes 5,000 ohms plate to plate. Has tertiary winding for 10% feed back and voice, coil windings of 4 and 8 ohms. Frequency response plus or minus 2 DB from 30 to 12,000 cycles. Down 6DB below 20 cycles and above 15,000 cycles. Furnished with connecting instructions. Size 3½x4x4¾ tall. Shipping weight 8 lbs. Stock No. 8X-55 net **$7.95.**

CONSOLE BASS REFLEX SPEAKER BAFFLE
$19.95

6 Cubic Foot Utility Bass Reflex Speaker Baffle. Size 32x22x16. Heavy construction with curved pleasing lines. Celotex lining assures non-rattle reproduction. Brown leatherette covered. Chrome front trim. Specify when ordering whether for use with a 12" or 15" speaker. Weight 40 lbs. This is an ideal baffle for our deluxe Coaxial model CR-13X. Baffle Stock No. NA-13. Net **$19.95.** CR-13X 12" Coaxial PM Speaker and NA-12 Baffle both for **$29.95.** You will be pleased with the fine tone of this combination.

McGEE'S FALL SPEAKER SALE—10 INCH 450 OHM FIELD SPEAKER $1.99

3000 SPEAKERS
450 OHM FIELD WITH P.P. 6K6 OUTPUTS
HERE'S THE GREATEST SPEAKER VALUE EVER

10" 450 ohm, with P.P. 6K6 output **$1.99**
8" 450 ohm with P.P. 6K6 output **1.99**
6x9" 450 ohm with P.P. 6K6 output **1.99**

All factory cartoned. **$1.99** each or buy 10 assorted for **$18.50.** These speakers produced for Majestic by Utah Celtron and Carbonama. Buy for less than half of the factory cost.

POPULAR FIELD COIL SPEAKERS

5" Utah 450 ohm speaker, with output for 50L6. This is a quality 5" speaker. Has full size coil and humbucking coil. A real special.....**$1.49**

4x6" 450 OHM OPERADIO

4x6", 450 ohm speaker, made by Operadio. Special, only **99c**

12" DYNAMIC BARGAINS

12" 450 ohm field speaker.....**$2.49**
12" 210 ohm field speaker.....**2.49**
12" 800 ohm field speaker.....**2.49**

Some have outputs. All are fine speakers by Magnavox, Operadio, Oxford, etc. Hottest special ever offered, each.....**$2.49**

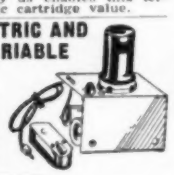
G.E. RPX010 V.R. CART. $2.95

G.E. RPX010, with permanent needle, **$2.95** each; 10 for **$24.95.**

Kit of parts to build 6SC7 type preamplifier, **$2.49** extra.

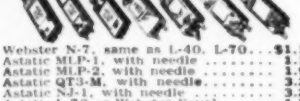
A lucky purchase by us enables this terrific General Electric cartridge value.

GENERAL ELECTRIC AND WEBSTER VARIABLE RELUCTANCE



New Webster cartridge with removable permanent needle. Response is second to none. Offered with preamplifier (6sc7) ready wired and tested. A scoop at **$5.95** complete

Webster M1-VR cartridge only. Net **$4.41**
New General Electric V. R. cartridge No. RPX-040, with removable needle. Net **$5.85**
General Electric V. R. cartridge RPX-041, for micro-groove records. Net **$5.85**
Our 6sc7 type pre-amplifier with either **RPX-040 or PRX-041 cartridge. Net $7.95**



Webster N-7, same as L-40, L-70...**$1.19**
Astatic MLP-1, with needle **1.19**
Astatic MLP-2, with needle **1.95**
Astatic QT3-M, with needle.....**3.29**
Astatic NJ-1, with needle **3.29**
Astatic L-72 or Webster Equal **1.79**
Astatic L-40 or Webster Equal **1.79**
Astatic L-70 or Webster Equal **1.79**
Take 10% off on 10-lot assortment.

SMALL SPEAKERS, NEAR MANUFACTURER'S COST

3½" 1 oz. magnet PM speaker.....**$0.99**
4" 1 oz. magnet PM speaker.....**.99**
4x6" 1 oz. magnet PM speaker.....**1.29**
5" 1 oz. magnet PM speaker.....**.99**

These speakers are all late production. Made for us by one of America's biggest speaker manufacturers. Packed 30 to the case. Order case lots. Deduct 5c for each speaker ordered.

BIG BARGAINS IN 4 OHM AUTO SPEAKERS

4" 4 ohm field speaker.....**$1.49**
5" 4 ohm field speaker.....**1.49**
6" 4 ohm field speaker, square.....**1.49**
6½" 4 ohm field speaker, round.....**1.49**
7" 4 ohm square. Philco Motorola.**1.98**
8" 4 ohm field speaker.....**1.98**

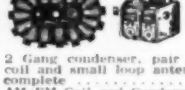
Made by Magnavox and Cinaudagraph.

SPECIAL AUTO SPEAKERS

5½", 4 ohm auto speaker, made by Magnavox. Fits some Motorola sets. A real **hot number. Special, only.....99c**
6x9" Magnavox, 4 ohm heavy duty auto speaker. Original equipment for General Motors **auto radios. Special.....$1.95**

5,000 4" AND 5" PM'S

5,000 4 and 5" PM's, 1 oz. Alnico V with mounting bracket. When McGee buys a bargain, so can you. Made by Permaflux. All brand new factory cartoned. Every speaker guaranteed perfect. Buy yourself a good supply at manufacturer's cost. Only 5,000 to sell, each.....**$0.89**
Buy 10 assorted speakers, 10 for.....**8.50**



COILS GANGS FM-AM

2 Gang condenser, pair of 456 IF's, osc. coil and small loop antenna. All matched, complete **99c**
AM-FM Coil and Condenser gang assembly. Consists of gang, and IF's. For FM and AM's. Broadcast OSC. loop, and instructions. Less than manufacturer's cost. A hot buy, at only **$1.95**
Universal, broadcast slug tuned antenna coil. Ideal for repairs. 80c value. Special **29c**
3 or 4 wire, standard 456 kc oscillator coils, **15c;** 10 for only **$1.25**
Loop antennas; for broadcast; small, medium or large. For replacement of outside antennas and repair jobs. Special, **19c** each; 10 for.....**$1.50**
Regular 456 kc I.F. transformers. Set of both input and output I.F. Special, only **$0.59**
10 sets for only.....**4.95**
Midget 456 kc. Iron Core I.F.'s. Set of input and output.....**98c**

CHOKES FOR RECEIVERS

50 MA., AC-DC Choke. Special.....**39c**
75 MA., AC-DC Choke. Special.....**49c**
150 MA. Choke, fully shielded, 8 henry. Special **98c**

HEAVY DUTY P.M. SPEAKERS
IDEAL FOR AUTO SET REPLACEMENTS

6" square 3.16 oz. Alnico V magnet.$2.29
7" square 3.16 oz. Alnico V magnet. **2.49**
6x9" 3.16 oz. Alnico V magnet.....**2.49**
8" square 3.16 oz. Alnico V magnet **2.98**

All late production, not surplus. All have ¾" voice coils and are made with a small square back to mount in any set.

5½" UTAH and output

5½" Utah PM, with 3Q5 output. Made for the famous overseas Zenith. Made with a 3 oz. magnet. A buy for only.....**$1.95**

6½" QUAM and output

6½" Quam PM speaker, 2.15 oz. Alnico V, with 50L6 output transformer. A $4.00 value. Special, only.....**$1.95**

6" G.E. PM and output

6" G.E. PM speaker, 3 oz. Alnico V magnet, with 8000 ohm output transformer. A $5.00 value. A honey for.....**$2.49**

Here's a sizzler. 8" Utah PM, with 4.64 oz. Alnico V magnet and 1" voice coil. A $5.00 wholesale value. Special.....**$2.98**

FAMOUS 12" MAGNAVOX

Famous 12" Magnavox PM speaker. 21 oz. Alnico 3, heavy seamless cone. We have sold 10,000 of this fine speaker. Only 800. Very special, **$4.95;** 5 for.....**$22.95**

1,500 6½" OPERADIO

6½" Operadio PM speaker. 1.47 Alnico V magnet. We have 1500 of this beautiful speaker. Fully dust proofed. 6½" PM made by Operadio. 1.47 oz. Alnico V PM. Buy a load at this unheard-of price. Each, **$1.29;** 10 for only.....**$12.00**

6" OXFORD and output

6" square Oxford. 1.5 oz. magnet, with P.P. output. Special, each.....**$ 1.79**
20 to a carton. Buy 20 for only.....**17.00**

10" OXFORD PM SPEAKER

10" Oxford PM speaker. 7 oz. Alnico V magnet. Special, half price.....**$3.49**

3" STIFF CONE TWEETER

3½" Tweeter, PM speaker with 5 oz. magnet of Alnico P. Thick stiff cone for high frequency. Ideal for intercom use. Special, **$1.29** each: 10 for.....**$11.00**

POWER TRANSFORMERS

60 MA., Fully Shielded Upright Mounting, 350 volt CT., 6.3 volt, 2 amp., 5 volt, 2 amp. Special **$1.95**
100 MA., Fully Shielded Upright Mounting, 700 volt CT., 6.3 volt, 4 amps., 5 volt, 3 amp. Made by Merit. Special **$2.95**
150 MA., Fully Shielded Upright Mounting, 750 volt CT., 6.3 volt, 5 amp., 5 volt, 3 amp. Very Special Value **$3.95**

200 MA., Fully Shielded, Flush Mounting, 800 volt, CT., 6.3 volt, 5 amp., 5 volt, 3 amp. Special **$3.95**
50 Mill Flush Mounting. For small radios 6.3 volt and high voltage CT. Net..**$1.95**

SALE AC LINE CORDS
For Radio Set Replacement

6½ ft. G.E. plastic AC cord and cap...**10c**
8 ft. G.E. plastic AC cord and cap....**22c**
6 ft. rubber AC line cord, bakelite plug. Special sale price.....**12c**

PLASTIC GRILL SPEAKER BAFFLES

Juke-box operators, Sound men, here is the prettiest line of speaker baffles you have ever seen. Tri-color curved plastic grills. Good plywood construction, with matched leatherette-covered sides.

12 IN. WALL BAFFLE $3.95

12" slanting wall baffle, with curved plastic grill. Stock No. 12-R: **$3.95.** Buy 4 for only **$14.95.**

8-10 IN. WALL BAFFLE $2.95

8" or 10" Flat mounting wall baffle, with plastic grill. Will hold either 8" or 10" speaker. Stock No. 8R: Your cost, **$2.95** each: 4 for **$10.95.**

12 IN. CORNER BAFFLE $3.49

Unique design 12" corner mounting baffle. Mounts snugly into corner, giving best sound distribution. Plastic front. Stock **No. 12-C:** Your cost, **$3.49** ea.; 4 for **$12.95.**

HIGH QUALITY P.M.
For Use With Above Batteries
12" P.M. $4.95

12 inch PM with 6.8 oz. Alnico V magnet. 8 ohm voice coil. This is the standard 12 inch PM of the sound industry. Ideal for juke boxes, PA systems and extension speakers. Stock No. Ch-12, net **$4.95;** three for **$13.95.**
High fidelity 12 inch 7 oz. Alnico V magnet PM speaker with molded curved wide range cone and 8 ohm voice coil. Stock No. 12-LI, net **$7.95.**
500 ohm line transformer to 3.2 or 8 ohm voice coil 18 watts, net each **$1.10;** 10 for **$9.95.**

SALE ON OUTPUTS
Regular Universal Output Transformers

2,000-14,000 ohms to voice coil.
4 watt, universal output.**$0.79**
8 watt, universal output. **.99**
12 watt, universal output. **1.19**

Special Push-Pull Output Transformers

Small ½" push-pull, for 50L6.....**49c**
¾" push-pull trans., for 6K6.....**59c**
¾" push-pull trans., for 6V6.....**59c**

Small Equipment Output Transformers

2,000 ohm, for 50L6 output.....**$0.39**
5,000 ohm, for 6V6 output.....**.39**
10,000 ohm, 3Q5 output.....**.39**
Assortment of 10 of these trans.....**3.89**

Push-Pull 6L6 Output Transformers!!!!

Special chrome plated, fully shielded heavy output transformer, for push-pull 6L6's. Made for Scott. A real $5.00 value. Your net price only.....**$2.95**

McGEE RADIO COMPANY

Prices F.O.B. K.C. Send 25% Deposit with Order, Balance C.O.D. With Parcel Post Orders, Include Postage

TELEPHONE VICTOR 9045. WRITE FOR FLYER
1422 GRAND AVE., KANSAS CITY, MISSOURI

TELEVISION

MATERIAL - SETS - TUBES - McGEE HAS IT!

WARD T.V. ANT. $6.49

MODEL TVH-9

Ward $26.50 list, all band T.V. antenna Model TVH-9. (Pictured). Stacked high and low band folded dipole with reflector. Furnished with mast as pictured. This is a terrific antenna buy. The regular dealers net was over $15.00. Buy them now at McGee's for only..... $6.49
10 for $59.95

WARD TVA-94 ..... $2.49

Ward TVA-94. Folded dipole, with 5 ft. mast. Shipped less 300 ohm line. The regular net on this antenna is $6.36. McGee's hot weather price..... $2.49

T.V. CHASSIS 30-TUBE, FOR 16" PICTURE TUBE BUILT FROM RCA PARTS $159.95

All RCA parts in this complete 16" Television Chassis for custom installations. Completely wired and tested with all tubes except the 16" picture tube. Has built-in voltage doubler for proper operation of 16" tube. This set is built 100% from RCA components and the famous RCA 630 Circuit. This is without a doubt the most television receiver you can buy. Offered at the low price of only $159.95. 16" picture tube, 16CP4 $39.95 extra. (16CP4 tube not sold separately). Stock #RCA-3016.
Stock #RCA-3012. Exactly the same as the 16" job described above only for a 12" T.V. Picture Tube $149.95. Dumont 12" Picture Tube $27.95 extra.

SAMS T.V. COURSE $3.00

Gives you a clear, complete understanding of T.V. principles, operation and practice. Covers: Beam Formation and Control; Beam Deflection Systems; Beam Modulation and Synchronization. Full analysis of the Cathode Ray tube, voltage supplies, control functions, antenna circuits, RF and IF systems, AGC, video amplification, contrast, etc. 216 pages: 8½ x 11"; profusely illustrated; sturdily bound.

Only $3.00

Sams T.V. Ant. Book — 192 pages $1.25

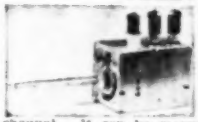
10" TABLE MODEL $149.95

Complete 20 Tube T.V. set in an attractive mahogany cabinet. Complete with all tubes including 10" Picture tube. We have sold dozens of this set with good dealer acceptance. Stock #A2010. 10" T.V. Receiver. Net $149.95.

12 INCH T.V. SET $189.95

Our Leader complete 24 tube 12 channel T. V. table model set complete with all tubes including picture tube. Made by a nationally known T. V. set builder. Regular retail price on this set is $239.95. Stock No. TV-46. McGee's scoop price $189.95.

SARKES TARZAIN 13 CHANNEL TELEVISION FRONT END $9.95



WITH DIAGRAMS

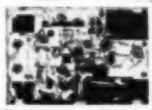
McGEE'S FALL SALE SPECIAL

SARKES-TARZIAN, 13 channel tuner for Television receiver. This 3 tube front end is all wired, including tube sockets. The same T.V. front end as used by several nationally known manufacturers. Built in fine frequency trimmer. Offered with printed schematic diagram. Priced complete with 3 tubes, 6C4 osc., 6AG5 mixer, and 6BH6 RF amplifier. This unit is worth twice our price. All wired, output is to be fed into your video channel. It can be mounted and used with the Farnsworth GVZ-60 chassis, advertised to the left. Weight 2 lbs. Stock No. SK-T3. Net price, Sarkes-Tarzian, 13 channel tuner, with 3 tubes..... $9.95

IT-SK3 13 channel T.V. front end same as SK-T3 except for intercarrier circuit (has no sound). Vernier built in furnished with tubes and diagram. Net..... $7.95

DUMONT $51.75 LIST 12QP4 NET $27.95

As usual, McGee offers you a better buy. We have on hand 100 Dumont 12QP4 Picture Tubes in original cartons, first quality, while they last only $27.95. This is the best value in the U.S. today.
10HP4 10" Picture Tubes, manufacturer states, these tubes are well within tolerance but not quite high enough to bear our brand name. McGee's tests fail to show any difference between this and any other 10HP4. Full factory guarantee. 10HP4, net..... $19.95
Sockets for either above tubes 49c each.



FARNSWORTH TELEVISION CHASSIS SCOOP.....$5.95

Farnsworth Television Chassis Model GVZ60 partially built up Chassis Size 12 x 17. Has 16 Tube sockets and over 150 small parts (Resister and Ceramic Condensers) no coils or Transformers or tuning unit. Sweep and sync circuits are all partially wired up. This T.V. Chassis is ideal for the student and experimenter. Learn T.V. by building your own set using this chassis to start from. Furnished with a 1948 regular $3.00 Supreme Publications Television Manual, which has a complete schematic of this chassis as well as 9 pages of service information.
If you want to play with Television here is a chance to get started.
Farnsworth GVZ60 partially built up Chassis and 48 Supreme T.V. Manual all for $5.95. Include postage for 11 lbs. GVZ60 Chassis only..... $2.95

T.V. POWER TRANS. SCOOP PRICE $2.95

Order This With Your Farnsworth T.V. Scoop Chassis

GVZ60 Power Transformer, C-94230Z. 135 Mil Tapped 110 Volt primary. Supplies plate voltage and filament for part of Farnsworth T.V. Chassis. 375 V.D.C. 6.3 and 5 filament. Shipping wt. 7 lbs. Scoop price..... $2.95

JEFFERSON T.V. PWR. TRAN (not pictured)

T.V. Power Transformer, similar to R.C.A. 290 ma. 110 volts, 60 cycle. 760 volts D.C., filaments 5 volts at 3 amps., 5 volts at 3 amps. and 6.3 volts at 6 amps. Frame size 3¾ x 4½ x 5¼". $6.95
Shipping weight, 12 lbs. Stock No. MB-4F. Net price..... $6.95

Television Vertical Deflection Output transformer. Shipping weight 2 lbs. Stock No. VD-5000. Net price..... $1.95

Television Focus Coil. Top quality for 10 or 12" tubes. R.C.A. No. 202D1. Net price..... $2.49

Horizontal Oscillator Transformer. Stock No. H-MA. Net price..... 99c

Electro "Magnetic" Ion Trap 69c

GENERAL ELEC. $50.00 AUDIO OSCILLATOR ONLY $19.95

Brand new in original factory cartons. G.E. Model YGA-4 Audio Oscillator. Frequency range 25 to 16,000 CPS. A red hot McGee Scoop while 100 last. Shipping weight 30 lbs. Net $19.95.

Latest Astatic curved arm, light weight pick-up. Molded plastic. Less than one ounce needle pressure. 4 volt, L-82 Astatic cartridge. Regular $3.30 wholesale value $2.29.

Same arm as above, but with L-70 cartridge. Special $1.99.

Webster, light weight stamped metal pick-up, with 4 volt high output cartridge. Very special, only $1.95.

Webster curved arm pick-up with normal voltage cartridge. Very special price, only $1.95.

Webster light weight plastic arm pick-up, with high output, 4 volt cartridge. Special, only $1.95.

OUR LEADER 7" PORTABLE $99.50

Made by a nationally known builder of finest radio and television equipment. Attractive portable case with telescopy V antenna. Made to retail originally for $150.00. Stock TVS-5. McGee's sale price only $99.50.

Sale McGRADE $13.95

McGrade Intercom. Master and sub-station, housed in small matching walnut plastic cabinets 5½x7x3½ inches. Sloping front for desk or wall installations. Furnished with 50 feet of inter-connecting wire. Sub-station may be used up to 1000 feet from master station. These units are new and factory cartoned. Complete with tubes. Made to retail at $29.95. A lucky purchase enables us to offer these to you for only $13.95. Include postage for 8 lbs. Stock No. MG-25.

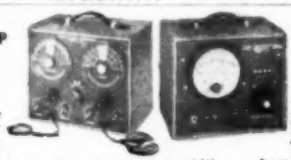
G.I. RM-4 $5.95

General Industries RM-4 heavy duty phono motor with T.T. 78 RPM. Scoop price..... $5.95
Deluxe quality 78 RPM phono motor with T.T. $2.95
Dual speed phono motor 331/3 or 78. Reg. $11.00 list, scoop price..... $4.95

REPLACEMENT MOTOR $1.29

Scoop-Replacement phono motor fits 90% of all changers. A scoop at only $1.29 ea.

APPROVED ELECTRONIC T.V. SWEEP AND MARKER GENERATOR NET $79.50



Approved Electronic Model A-400 Sweep Signal Generator for Television and F.M. as well as a Marker generator. Sweep Gene-Range 0 to 227 Megacycles. Sweep width variable from 0 to 12 Megacycles. Internal marker 20 to 40 Megacycles. Priced complete ready to operate. Tube component 6J6, 6AU6, 36C4, 714. A good quality test instrument for T.V. servicing at the right price. Model A-400. Shipping weight 25 lbs. Net $79.50

APPROVED ELECTRONIC T.V. FIELD STRENGTH METER $79.50

Approved Electronic Model A-460 Television Field Strength Meter. 110 Volt AC operated. 12 Channel continuously variable tuning. 0" meter calibrated from 50 to 30,000 microvolts. Earphone jack. Also may be used to check efficiency of T.V. boosters. Punched ready to operate with 8 tubes. Shipping weight 25 lbs. Net $79.50.

Model 221-K Eico High precision vacuum Tube-Volt-Ohm Meter Kit. All parts, tubes and instructions furnished. AC-DC. Ranges 0, 5, 10, 100, 500 and 1000 Volts. Ohms in 5 steps. .2 ohms to 1000 megs. New feature includes zero center for T.V. discriminator alignment. 4½" meter. Kit Model 221-K. Weight 12 lbs. Net $23.95.

Eico Model 32-K Signal Generator Kit. All parts, tubes and instructions furnished. 7 Bands. 150 KC to 100 M.C. Fundamentals to 34 M.C. A tremendous value. Shipping weight 12 lbs. Net $19.95.

BUILD THESE THREE TEST INSTRUMENTS AND HAVE THE BEST.

Model 400-K 5" Scope Kit. All parts and tubes furnished. Ready punched Chassis and beautiful metal case. Sensitivity .3 Volts. Sweep 15 to 30 K.C. Tube component 2, 6SJ7, 2, 5Y3, 884 and 5BP1. This Eico Scope Kit is the best. Shipping weight 40 lbs. New $39.95.

VOLT OHM METER KIT $14.95

Electronic Instrument Volt Ohmmeter Kit. 3" meter. 1000 ohms per volt sensitivity. 5 D.C. volt ranges to 2500 volts. 4 A.C. voltage ranges to 1000 volts. 3 ohms ranges to 1 meg —complete kit. Stock #511K. net $14.95.

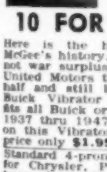
SOLAR METAL F.P. CONDENSERS

POPULAR TWIST MOUNTING IN ALUMINUM CANS

8 Mfd. 450 volt FP condenser	29c	25-25 Mfd. 25v FP	19c
16 Mfd. 450 volt FP condenser	34c	40 150v, 20 25v FP	15c
20 Mfd. 450 volt FP condenser	39c	40-40 Mfd. 150v FP	29c
30 Mfd. 450 volt FP condenser	39c	24-16 Mfd. 350v	39c
20 Mfd. 525 volt FP cond. Special	49c	20-10 350v 20 25v	39c
30 450v, 20 25v FP	39c	15-15 450v 20 25v	59c
40 250v, 20 25v FP	19c	40-40 Mfd. 450v	59c

Order 100 Assorted Solar Condensers and Take 10% Discount from Above Prices.

$50,000 DELCO VIBRATOR SCOOP



BUICK VIBRATOR FITS ALL BUICK SETS FOR 11 YEARS 1937 THRU 1947

McGEE'S PRICE $1.95

10 FOR ONLY $17.95

Here is the hottest Vibrator Scoop in McGee's history. All new Delco Vibrators, not war surplus, but vibrators dumped by United Motors themselves. You save over half and still buy the best. This Delco Buick Vibrator replaces Mallory #7161 fits all Buick original equipment sets from 1937 thru 1947. The regular dealers net on this Vibrator is $4.14. McGee's sale price only $1.95. 10 for $17.95.

Standard 4-prong, 1½" can, short enough for Chrysler, Plymouth sets. 8-point, heavy duty. Replaces Mallory 294. Regular dealers' net, $2.62. McGee's price, $1.29; 10 for $11.90.

Odd 4-prong, 1½" can Delco 1301, replaces Mallory 852. Popular GM car sets. Regular $2.46. McGee's price, $1.49; 10 for $12.95.

Chevrolet vibrator, Delco No. 8622, replaces Mallory 273D. Can size 2x4½". A sync with buffers. Odd 5-prong. McGee's price, $1.95.

Delco No. 8611, replaces Mallory 245A. A standard 5-prong sync, no buffers. Can size 2x3½". McGee's price, $1.95.

Delco 8612, replaces Mallory 271HD. Offers 5-prong sync, no buffers. Can size 1½x3¼". McGee's price, $1.49.

Delco 8637, replaces Mallory 954. Standard 6-prong sync, no buffers. 1½x3¼" can. McGee's price, $1.49.

Delco 8610, replaces Mallory 245. 1½x3¼" can. 5-prong sync, no buffers. McGee's price, $1.49.

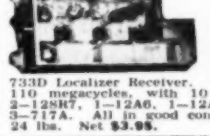
DELCO VIB UNITS

Delco sync vibrator unit, with buffer condensers attached. This one is used in all sync vibrators, regardless of case size. If buffers are not needed, simply clip off. You save up to $4.00 by replacing the unit in your old vibrator can. $1.09 each; 10 for $9.95.

Delco 8 point, heavy duty, non-sync replacement vibrator unit. The best non-sync unit known today. For regular and heavy duty replacement use. Small in size. Fits them all. Net 99c each, 10 for $8.95.

BC-456 Modulators $2.00

BC 456 Modulators with tubes, used but in good condition. While they last, net each $2.00. Weight 11 lbs. Dynamotor for BC-456 $1.00 extra. Weight 9 lbs.



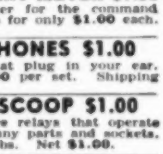
10-TUBE 733D LOCALIZER RECEIVER $3.95

733D Localizer Receiver. Receives 108 & 110 megacycles, with 10 tubes: 12SQ7, 2—12SH7, 1—12A6, 1—12AH7, 2—12SC7, 3—717A. All in good condition. Weight 24 lbs. Net $3.95.

SCR-518 RADIO ALTIMETER, $19.95 Complete, New, with 29 Tubes

Famous SCR 518 A Altimeter. Brand new factory cartoned. Worth over $9000.00. Made by RCA. Complete as pictured. Has 29 tubes. Works in the 500 MC region. This is the complete unit. Transmitter, receiver, power supply and 3" scope indicator. Reads altitude up to 30,000 ft. Operates on 28 volts D.C. Complete with tubes, 6SK7, 2 8012, 2 6SJ7, 6C8, 6SN7, 6F8, 2B/4, 6V6, 10 6AC7, 3 2X2, 954, 955, 956, 6J5 and 3 in. CR tube 1805P1. A RED hot scoop at only $19.95 complete. Weight 100 lbs.

BC-458 TRANSMITTER Sale Price $3.95



Brand new BC-458 Command Transmitters, with tubes. 5.3 to 7 mc. Only a few hundred left. Shipping weight 11 lbs. Scoop price $3.95.

ANTENNA CURRENT METER $1.00

Antenna current meter for the command transmitter. A scoop for only $1.00 each. Weight 3 lbs.

TINY EAR PHONES $1.00

Small ear phones that plug in your ear. While they last $1.00 per set. Shipping weight 3 lbs.

CIT. RELAY SCOOP $1.00

Has 6 high resistance relays that operate on 8 mills. Also many parts and sockets. Shipping weight 13 lbs. Net $1.00.

McGEE RADIO COMPANY

PRICES F.O.B. K.C. Send 25% Deposit with order. Bal. Sent C.O.D. With parcel post orders include postage.

TELEPHONE VICTOR 9045. Write for Flyer
1422 GRAND AVE., KANSAS CITY, MISSOURI

Columbia
GEM OF THE SURPLUS

COMBINATION SPECIAL!

3-6 mcs. Receiver and a 4-5.3 mcs. or 5.3-7 mcs. Transmitter, less top cover. Used, good cond. With all tubes and crystal. Per Set **$6.50**

CE-1 SPEAKER: Similar to LS-7 Army speaker. 4.5 x 4.5 x 3 in. With clamp for mounting. Has 5 ft. cord with PL-55. Ready for use with high or low imp. transformer. NEW **$4.95**

HICKOK & SUPREME VOM METERS: 6 x 7 x 6 in. Housed in either wooden or metal carrying case with handle. Has 4 ranges on ohms, 9 ranges on AC and output, 6 ranges on DC that extend up to 1500 V. All self-contained. Pipe the prices!
Used, in excellent condition ..... Ea. **$22.50**
Used, in good condition ..... Ea. **17.50**

RG8U COAX CABLE: New. Per foot ... **5c**
Per 100 feet **$4.75**

SCR 515 BC 645 TRANSCEIVER. Ready for citizens' band with slight modification. Comes complete with following: transceiver unit, control box, dynamotor, rack, all plugs and antennas. Brand new. Each **$19.95**

WALKIE-TALKIE: BC-322. 52 to 65 mcs. Hot on 6 meters. Increase the number of turns on coil to put it on 10 meters. Excellent cond. Complete less antenna, battery and handset **$10.95**

WALKIE-TALKIE: BC-222. 28 to 52 mcs. Very few left **$12.95**

APR-1 & APR-4 TUNING UNITS: Just what you need to get into ultra-high freq. bands. Contains an RF and/or oscillator and first detector. Will operate as converter or as front end of a UHF receiver. These are electrically perfect.
APR-1 TN-1 freq. range 40-90 mcs. Ea. **$29.50**
APR-1 TN-2B " " 80-300 mcs. Ea. **32.50**

Write in for SPECIAL PRICES on following:
APR-1 TN-3B freq. range 300-1,000 mcs.
APR-1 TN-4A " " 500-1,000 mcs.
APR-4 TN-16 " " 38-95 mcs.
APR-4 TN-17 " " 74-320 mcs.
APR-4 TN-18 " " 300-1,000 mcs.
APR-4 TN-19 " " 975-2,200 mcs.
APR-4 TN-54 " " 2150-4,000 mcs.

TRY VIBRATOR POWER SUPPLY

4 volt input. 156 volts for plate 3 volts, 1.5 volt, -7½ volts. With polarity switching relay. Has adapter for charging from 6 V. supply. It's terrific for portable battery sets, mobile units and small transmitters. Excellent condition. A $20.00 value for only **$8.95**

2 V-WILLARD WET CELL BATTERIES

Excellent for use with TBY Vibrator Power Supply (above). Brand new, individually boxed. Each **$1.49**
Order 2 for only **$2.75**

For More Dope on Following Items See Our Ad Sept. 1949 Radio News Pg. 148

Racks: Single, **$1.29**; Double **$1.79**
Pots: 5,000, 20,000, 250,000 ohms. 15 for **1.50**
BC-1068 Receiver. Excellent condition .. **24.50**
Aerovox Oil Filled Condenser ..... **.49**
10 assorted oil filled bathtub and mica condensers, 600 B. Box of ten **2.25**
De Jur Meter, 3 in. square **2.95**
FOR TUBE PRICES see ad P. 100 Aug.-1949 RADIO NEWS

Come on in and see the tremendous stock in one of the largest SURPLUS ELECTRONICS companies in the country. Send orders to

COLUMBIA ELECTRONICS SALES
522 South San Pedro Street
LOS ANGELES 13, CALIFORNIA

NEW AUTOMATIC PLOTTING RAYDIST SYSTEM

Developed by the Hastings Instrument Co., Inc., for the U. S. Navy Bureau of Ships.

A TINY SHIP sailing a vast, dry sea and at the same time automatically reproducing in miniature the maneuvers of a real ship many miles away is a recent scientific development. The device was designed for precise marine navigation and hydrographic survey operations. The tiny ship is part of a new system known as a Raydist Plotting Board. The dry sea on which it sails is in reality a U.S. Coast and Geodetic Chart, or map, that shows the coastline, the harbors, rivers, and channels, as well as sandbars and reefs.

Several years ago the potentialities of the Raydist System were recognized by the military services, and the Bureau of Ships obtained the first two-dimensional Raydist set. After more than a year of successful experience with this equipment, the Bureau of Ships sponsored additional development which has resulted in the latest link in the Raydist System—a completely automatic plotting board on which a small ship with a recording pen attached moves directly on a chart or map showing the exact position of the ship being tracked, with an accuracy limited only by the size and readability of the chart.

In the operation of the Raydist System, a small radio transmitter installed on the full-size ship sends its signal to several receivers on shore. These signals are used to pin-point the exact location of the ship. These receivers in turn transmit their data to devices known as servo mechanisms which push and pull on the miniature ship by means of flexible steel tapes to reproduce on the chart the course of the ship.

By watching the model maneuvering on the chart an observer on shore can follow the exact course of a ship miles away, with accuracies unobtainable in the past with all known methods of navigation. With the plotting board installed on board ship, it will be possible to safely navigate narrow, twisting channels under adverse weather conditions precisely and with complete confidence.

The Raydist System is accurate to one foot in a mile, or in other words, at a distance of five miles, this system would show the position of a ship to within five feet of its exact position. With the plotting techniques used in normal navigation procedures this accuracy is so fine that the errors cannot be seen on the chart.

Completely automatic Raydist Systems have been successfully employed to track aircraft, vehicles, small boats, and ships. Many of these tests were purposely conducted under adverse weather conditions such as rain, snow, and fog, when optical measurements would not have been practical. Ranges in excess of 100 miles have been realized with a hyperbolic Raydist System tracking ships at sea. The maximum radiated power for these tests was only 10 watts. In field tests involving U.S. Coast and Geodetic Survey distances above one mile, Raydist has repeatedly proven to be accurate to one part in five thousand.

In addition to the Navy's immediate problem of tracking ships, it is anticipated that Raydist Systems and Automatic Plotting Boards will be used for oil exploration, hydrographic surveys, charting of rivers and channels, and general air and marine navigation and guidance.

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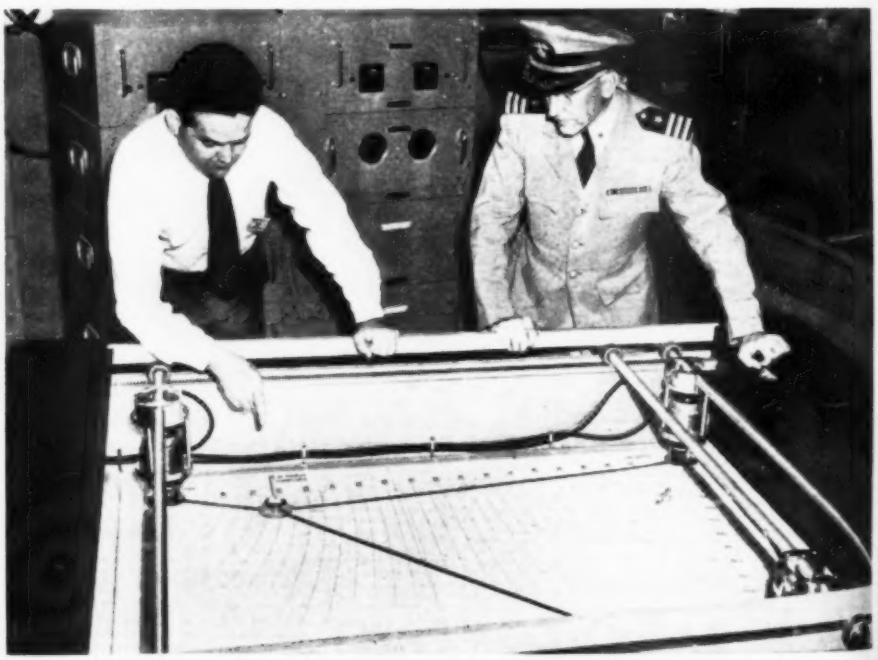
Following the course of a ship in mid-ocean by means of the Raydist Plotting Board.



MONEY BACK GUARANTEE—We believe units offered for sale by mail order should be sold only on a "Money-Back-If-Not-Satisfied" basis. We carefully check on the design, calibration and value of all items advertised by us and unhesitatingly offer all merchandise subject to a return for credit or refund. You, the customer, are the sole judge as to value of the item or items you have purchased.

The New Model TV-20 A COMBINATION **20,000** OHMS PER VOLT **MULTI-METER and TELEVISION KILOVOLTMETER**

ADDED FEATURE
Includes an Ultra High Frequency Voltmeter Probe with a frequency range up to 1,000 MEGACYCLES. When plugged into the Model TV-20, the V. H. Probe converts the unit into a Negative Peak-Reading H. F. Voltmeter.

The Model TV-20 operates on self-contained batteries. Comes housed in beautiful hand-rubbed oak cabinet complete with portable cover, Built-In High Voltage Probe, H. F. Probe, Test Leads and all operating instructions.

$39.95 NET

9 D. C. VOLTAGE RANGES: (At 20,000 ohms per Volt) 0-2.5/10/50/100/250/500/1,000/5,000/50,000 Volts

8 A. C. VOLTAGE RANGES: (At 1,000 ohms per Volt) 0-2.5/10/50/100/250/500/1,000/5,000 Volts

5 D. C. CURRENT RANGES: 0-50 Microamperes 0-5/50/500 Milliamperes 0-5 Amperes

4 RESISTANCE RANGES: 0-2,000/20,000 ohms 0-2/20 Megohms

7 D. B. RANGES: (All D. B. ranges based on ODb = 1 Mw. into a 600 ohm line:
— 4 to + 10 db
+ 8 to + 22 db
+ 22 to + 36 db
+ 28 to + 42 db
+ 36 to + 50 db
+ 42 to + 56 db
+ 48 to + 62 db

7 OUTPUT VOLTAGE RANGES: 0 to 2.5/10/50/100/250/500/1,000 Volts

THE NEW MODEL TV-10

TUBE TESTER

The Model TV-10 operates on 105-130 Volt 60 cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

$39.50 NET

SPECIFICATIONS:

Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut Bantam, Hearing-aid, Thyratron, Miniatures, Sub-Miniatures, Novals, etc. Will also test Pilot Lights.

Tests by the well-established emission method for tube quality, directly read on the scale of the meter.

Tests for "shorts" and "leakages" up to 5 Megohms.

Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-10 as any of the pins may be placed in the neutral position when necessary.

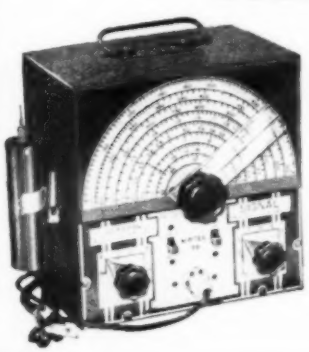
The Model TV-10 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.

Free-moving built-in roll chart provides complete data for all tubes.

Newly designed Line Voltage Control compensates for variation of any line voltage between 105 Volts and 130 Volts.

The Model 88—A COMBINATION

SIGNAL GENERATOR AND SIGNALTRACER



Signal Generator Specifications:
*Frequency Range: 150 Kilocycles to 50 Megacycles. *The R.F. Signal Frequency is kept completely constant at all output levels. *Modulation is accomplished by Grid-blocking action which is equally effective for alignment of amplitude and frequency modulation as well as for television receivers. *R.F. obtainable separately or modulated by the Audio Frequency.

Signal Tracer Specifications:
Uses the new Sylvania 1N34 Germanium crystal Diode which combined with a resistance-capacity network provides a frequency range of 300 cycles to 50 Megacycles.

The Model 88 comes complete with all test leads and operating instructions. ONLY **$28.85 NET**

The New Model TV-30 **TELEVISION SIGNAL GENERATOR**

Model TV-30 comes complete with shielded co-axial lead and all operating instructions.

$29.95 NET

Enables alignment of television I. F. and FRONT ENDS without the use of an oscilloscope.

SPECIFICATIONS

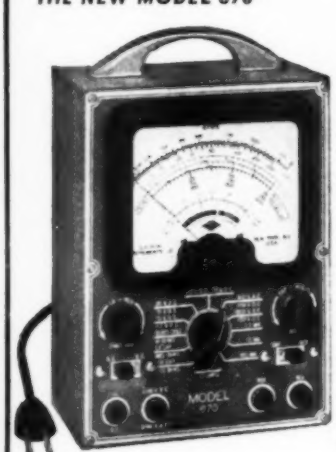
Frequency Range: 4 Bands—No switching
18— 32 Mc.
35— 65 Mc.
54— 98 Mc.
150—250 Mc.

Audio Modulating Frequency: 400 cycles (Sine Wave)
Attenuator: 4 position, ladder type with constant impedance control for fine adjustment.

Tubes Used:
6C4 as Cathode follower and modulated buffer.
6C4 as R.F. Oscillator.
6SN7 as Audio Oscillator and power rectifier.

THE NEW MODEL 670

SUPER METER



A Combination VOLT-OHM-MILLIAMMETER plus CAPACITY REACTANCE, INDUCTANCE and DECIBEL MEASUREMENTS.

D.C. VOLTS: 0 to 7.5/15/75/150/750/1500/7500. **A.C. VOLTS:** 0 to 15/30/150/300/1500/3000 Volts. **OUTPUT VOLTS:** 0 to 15/30/150/300/1500/3000. **D.C. CURRENT:** 0 to 1.5/15/150 ma.; 0 to 1.5 Amps. **RESISTANCE:** 0 to 500/100,000 ohms, 0 to 10 Megohms. **CAPACITY:** .001 to .2 Mfd., .1 to 4 Mfd. (Quality test for electrolytics.) **REACTANCE:** 700 to 27,000 Ohms; 13,000 Ohms to 3 Megohms. **INDUCTANCE:** 1.75 to 70 Henries; 35 to 8,000 Henries. **DECIBELS:** -10 to +18, +10 to +38, +30 to +58.

The model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½" x 7½" x 3".

$28.40 NET

An Accurate Pocket Size

THE NEW MODEL 770 **VOLT-OHM MILLIAMMETER**

(Sensitivity: 1000 ohms per volt)

Features:
Compact, measures 3¼" x 5⅞" x 2¼". Uses latest design 2% accurate 1 Mil. D'Arsonval type meter. Same zero adjustment holds for both resistance ranges. It is not necessary to readjust when switching from one resistance range to another. This is an important time-saving feature never before included in a V.O.M. in this price range. Housed in round-cornered, molded case. Beautiful black etched panel. Depressed letters filled with permanent white, insures long life even with constant use.

Specifications: 6 A.C. VOLTAGE RANGES: 0-15/30/150/300/1500/3000 volts. **6 D.C. VOLTAGE RANGES:** 0-7½/15/75/150/750/1500 volts. **4 D.C. CURRENT RANGES:** 0-1½/15/150 Ma./0-1½ Amps. **2 RESISTANCE RANGES:** 0-500 ohms, 0-1 Megohm.

The Model 770 comes complete with self-contained batteries, test leads and all operating instructions.

$13.90 NET

20% DEPOSIT REQUIRED ON ALL C. O. D. ORDERS

GENERAL ELECTRONIC DISTRIBUTING CO. DEPT. RN-10, 98 PARK PLACE, NEW YORK 7, N. Y.

an EYEFULL of a good LISTENER

Modern, functional styling is just one feature of the new Turner Model 25. It's carefully engineered to listen attentively to voice, music, or sound and to reproduce faithfully without distortion. Not temperamental about operating conditions but dependable indoors or out. The Turner Model 25 is designed to travel in good company. It's recommended for all sound work and gives exceptional performance when teamed up with high quality equipment. Available with either crystal or dynamic circuits. Ask your dealer. Write for complete literature.

The Turner Model 25

Model 25X Crystal.....$27.50
Model 25D Dynamic.....$40.00

Two-tone gunmetal grey finish with chrome plated grill standard. Satin chrome finish at slight extra cost. Stand extra.

THE TURNER COMPANY
900 17th Street N.E., Cedar Rapids, Iowa

IN CANADA: Canadian Marconi Co., Ltd.
Montreal, P.Q., and branches

EXPORT: Ad. Auriema, Inc.
89 Broad St., New York 4, N.Y.

TURNER

Microphones licensed under U.S. patents of the American Telephone and Telegraph Company, and Western Electric Company, Incorporated. Crystals licensed under patents of the Brush Development Company.

RELAYS FOR COMMUNICATIONS PASS RIGID TEST

COVER PHOTO

THE great majority of purchasers of radio-electronic components have never had the opportunity to eavesdrop on a manufacturer to see just how these components are designed, assembled, and tested. To the average layman, it is a matter of basic specifications that will best do the job at hand.

Take the relay as an example. Did you ever stop to consider this item as one having any unusual problems of design, other than to open or close circuits? There's a lot of engineering required in the design of components, and the editors decided to send our photographer over to visit a prominent relay manufacturer to see what goes on "behind the scenes." The Kodachrome on our front cover this month shows the final operation before these *Advance* relays are packed for shipment to makers of radio, electronic, radar, aircraft, and to many government agencies, including the Army, Navy, Air Force, and Atomic Energy Commission.

They must withstand rigid operational heat, humidity, and shock tests. This requires that the relays be subjected to operational tests in ovens and dry ice refrigerators. They must also be operated while attached to a vibrating machine with accelerations up as much as 25G's. Most present-day military specifications require relays to operate in any temperature ranging from −55°C. to +70°C. Since this wide temperature range causes a great fluctuation in the d.c. resistance of any coil, it is necessary that this variation be computed when running operational tests.

For example, a coil having a resistance of 1000 ohms at normal temperature, 20°C., would be reduced to 700 ohms at −55°C. and would rise to 1200 ohms at +70°C. Instead of placing each relay under the actual temperature conditions, the variation is simulated when making the final operational tests; then it is only necessary to run the complete test on about 10 per-cent of any given order.

In addition to the heat checks noted, all such relays must be fabricated so as to withstand 95 per-cent humidity and are usually fungus-proofed and tropicalized.

In a future issue, we'll visit more plants for a peek "backstage."

—30—

ANOTHER OUTSTANDING JOBBER
PIONEER RADIO SUPPLY CO.
2115 PROSPECT ST.
Cleveland 15, Ohio

$39.95

HAS THE SENSATIONAL NEW EICO 400-K 5" Scope Kit IN STOCK!

PIONEER RADIO SUPPLY CO.
215 Prospect St. Cleveland 15, Ohio
Dear Sirs: Enclosed find check or money order in the amount of $_____, for which please send me the following:

_____ No. 400-K @ $39.95
_____ No. 221-K @ $23.95
_____ No. 320-K @ $19.95
_____ No. 145-K @ $18.95
_____ No. 511-K @ $14.95
_____ No. P75-K @ $ 3.75

Name _____
Address _____
City _____ State _____
Please include 3% Ohio State sales tax.

RADIO ENGINEERING!
DEGREE IN 27 MONTHS

COMPLETE Radio Engineering Course. Television B.S. degree. Courses also in Civil, Elec., Mech., Chem., Aeronautical Engineering, Bus. Admin., Acc., Sec., Science. Visitors welcome. See beautiful campus, well equipped laboratories. Graduates successful. 66th year. Enter Sept., Jan., March, June. Write for catalog.

TRI-STATE COLLEGE
16109 College Ave.
Angola, Indiana

TELEVISION RECEIVER—$1.00
Complete instructions for building your own television receiver. 16 pages—11" x 17" of pictures, pictorial diagrams, clarified schematics, 17" x 22" complete schematic diagram and chassis layout. Also booklet of alignment instructions, voltage and resistance tables and trouble-shooting hints. —All for $1.00.
CERTIFIED TELEVISION LABORATORIES
5507-13th Ave., Brooklyn 19, N. Y.

PERMALLOY SHIELDS
for CATHODE RAY TUBES

3" Shield..... $1.47
5" Shield..... 1.97

R·H·S
SPECIALS OF THE MONTH

NOW AVAILABLE

1000 KC Crystal..... $2.97
Socket..... .07

TUBES!! BRAND NEW! STANDARD BRANDS! NO SECONDS! COMPARE! TUBES!!

1B21	$ 2.87	3EP1	$ 2.87	305A	$12.95	843	$ .39	C100D	$ 1.95	01A	$ .25	6A6	$ .89	6U5	$ .65	19	$ .98
1B22	3.95	3E29	8.97	307A	3.95	845W	4.25	CK507AX	1.95	1A3	.57	6A7	.69	6U7G	.55	24A	.67
1B23	8.95	3FP7	1.75	316A	.54	851	15.95	CK1005	.19	1A4	1.09	6AN	.79	6V6	.97	25L6	.53
1B24	4.69	3GP1	6.75	327A	2.75	860	2.49	CK1006	.98	1A4P	.97	6AB7	.79	6V6GT	.63	25Z5	.49
1B26	4.57	4-65A	14.49	338A	3.95	861	10.95	CK1090	2.95	1A5GT	.69	6AC7	.77	6X4	.49	25Z6	.49
1B27	8.95	4-125A	27.45	350A	1.25	864	.49	EF50	.45	1A6	.79	6AF6G	.79	6X5GT	.49	26	.57
1B29	3.49	4-250A	37.45	350B	1.89	865	2.95	F123A	12.95	1A7GT	.67	6AG5	.77	6Y6G	.67	27	.47
1B36	4.59	4AP10	5.95	353A	2.95	866A	1.05	F125A	14.95	1AB5	.69	6AG7	.98	6Z7G	1.15	28D7	.35
1B38	47.50	4B24	3.95	353B	7.95	866JR	1.10	F127A	27.50	1B4	1.19	6AH6	1.29	6ZY5G	.69	30	.57
1D21	5.75	4C35	19.50	362A	1.95	869B	27.95	F128A	69.50	1B5/25S	.89	6AJ5	.79	7A4/XXL	.59	31	.89
1N21	.95	4E27	17.75	368AS	3.95	872A	1.49	F606	22.50	1C5GT	.67	6AK5	.85	7A6	.67	32	.97
1N21B	1.65	4J32	97.50	371B	.85	874	.57	F660	125.00	1C6	.89	6AK6	.79	7A7	.57	32L7GT	.97
1N23	.79	5AP1	1.95	388A	2.95	876	.98	FS62A	450.00	1C7G	.89	6AL5	.65	7AG7	.72	33	.69
1N23B	1.95	5AP4	1.95	393A	3.85	878	1.98	FG17	2.89	1D5GP	.97	6AQ5	.69	7B4	.57	34	.69
1N34	.85	5BP1	1.89	394A	3.85	884	1.39	FG27A	9.75	1D7G	.89	6AQ6	.59	7B6	.59	35/51	.57
1P24	.79	5BP4	3.75	417A	14.50	885	1.39	FG81A	3.85	1D8GT	.95	6AT6	.47	7B7	.59	35A5	.67
1S21	3.95	5CP1	1.85	434A	3.50	902P1	3.85	FG95	17.95	1F4	.75	6AU6	.89	7C4	.37	35B5	.65
2AP1	3.89	5CP1A	9.95	446A	1.25	905	3.98	FG105	9.95	1F5G	.75	6AV6	.47	7C5	.57	35C5	.65
2C21	.27	5CP7	9.95	450TH	17.95	908	4.95	FG172	19.95	1G4GT	.69	6B4G	.89	7C7	.59	35L6	.54
2C22	.19	5C30	7.95	450TL	37.50	923	.97	FT210	13.95	1G6GT	.69	6B6G	.79	7E5	.67	35W4	.39
2C26	.19	5D21	27.95	527	9.95	930	.85	GL146	9.95	1H4G	.69	6B7	.89	7E6	.59	35Y4	.49
2C34	.27	5FP7	1.35	559	.85	931A	2.69	GL451	3.25	1H5GT	.54	6BA6	.89	7E7	.69	35Z3	.57
2C40	6.50	5GP1	5.95	575A	12.95	953B	19.95	GL562	85.00	1H6GT	.87	6BA6	.55	7F7	.69	35Z4	.44
2C43	8.95	5JP1	24.95	700A/B/C/D	34.50	954	.37	GL697	69.50	1J6GT	.89	6BE6	.57	7H7	.64	35Z5	.39
2C44	6.67	5JP2	11.75	701A	3.60	955	.37	HY115	.85	1L4	.55	6BF6	.57	7L7	.69	37	.35
2C46	6.87	5J29	17.50	702A	3.25	956	.39	HY615	.79	1LA4	.79	6BG6G	1.47	7N7	.67	38	.29
2C51	8.25	5J30	49.50	703A	3.95	957	.24	HYE1148	.39	1LA6	.89	6BH6	.57	7Q7	.59	39/44	.27
2D21	1.17	5LP1	13.95	705A	1.10	958A	.35	KC4	49.50	1LB4	.89	6BJ6	.59	7R7	.69	41	.52
2E22	1.29	5NP1	2.89	706CY	18.75	959	.37	KU610	9.75	1LC5	.79	6C4	.25	7W7	.89	42	.49
2E24	4.87	6C21	19.69	707B	14.95	991	.27	ML100	49.50	1LC6	.57	6C5	.47	7X7	.89	43	.49
2E26	3.49	6F4	5.59	708A	3.95	1603	3.95	ML101	139.50	1LD5	.79	6C6	.57	7Y4	.57	45	.52
2J21A	10.95	6J4	5.95	713A	.95	1611	.97	ML501	69.50	1LE3	.89	6C8G	.69	7Z4	.57	42	.49
2J22	8.95	7BP7	4.65	714A	12.95	1613	.59	ML502	149.50	1LG5	.89	6D6	.47	12A	.57	43	.49
2J26	7.95	9GP7	12.50	714AY	3.95	1614	1.45	REL21	2.95	1LH4	.65	6D8G	.87	12A6	.19	45	.52
2J27	13.95	9JP1	6.95	715C	24.95	1616	.98	REL36	.79	1LN5	.67	6E5	.69	12A7	.98	45Z3	.57
2J30	49.50	9LP7	2.25	717A	.59	1619	.24	RK21	.79	1N5GT	.59	6F5	.47	12ANGT	.59	45Z5	.49
2J31	9.75	10BP4	24.95	721A	2.95	1624	.98	RK23	4.85	1P5GT	.67	6F6	.65	12AU7GT	.89	46	.69
2J32	5.95	10Y	.49	723A/B	24.95	1625	.37	RK25	3.65	1Q5GT	.69	6F7	.87	12AT6	.45	47	.69
2J33	19.95	12DP7	14.95	724A/B	3.95	1626	.37	RK33	.27	1R4	.69	6F8G	.87	12AU6	.67	50A5	.69
2J34	19.95	12GP7	13.95	725A	8.95	1629	.27	RK34	.27	1R5	.69	6G6G	.69	12AU7	.79	50B5	.55
2J37	17.50	12HP7	13.95	726A	14.95	1630	3.95	RK59	1.95	1S4	.79	6H6	.47	12BA6	.57	50L6	.52
2J38	12.95	15E	1.29	730A	10.95	1631	1.45	RK63	18.95	1S5	.57	6J5	.49	12BE6	.49	50Y6	.57
2J39	34.50	15R	.79	750TL	45.00	1632	.98	RK65	24.95	1T4	.57	6J6	.77	12C8	.99	53	.87
2J40	49.50	23D4	.29	800	1.95	1633	.98	RK72	.97	1T5GT	.79	6J7	.67	12F5GT	.58	56	.45
2J46	89.50	24G	.47	801A	.49	1636	4.75	RK73	.97	1U4	.59	6K6GT	.45	12H6	.27	57	.38
2J48	39.50	30 Spec	.35	802	4.25	1638	.79	RX21	3.19	1V	.69	6K7	.49	12J5	.27	58	.49
2J49	24.95	45 Spec	.29	803	4.95	1641	.69	RX120	8.95	2A3	.97	6K8	.79	12K7	.54	59	.89
2J50	42.50	75TL	2.95	804	8.95	1642	.27	SS36	2.95	2A4G	1.07	6L5	.89	12K8	.59	70L7	1.17
2J53	14.95	100R	1.85	805	4.95	1665	1.10	TZ40	2.95	2A5	.69	6L6	1.17	12Q7	.49	71A	.67
2J54B	39.50	100TH	11.50	807	1.10	1851	.97	V70D	6.95	2A6	.79	6L6GA	.87	12SA7	.57	75	.53
2J61	39.50	100TS	2.35	808	1.39	1960	2.95	VR65A	.98	2A7	.89	6L7	.79	12SC7	.57	76	.39
2J62	39.50	204A	57.50	809	2.75	2050	.75	VR75	.97	2V3G	.99	6N7	.79	12SF7	.57	77	.43
2K25	23.95	205B	1.75	810	6.95	2051	.43	VR78	.65	2X2	.39	6Q7	.59	12SG7	.57	78	.45
2K28	14.95	211	.49	811	2.10	7193	.19	VR90	.67	2X2A	.69	6R7	.79	12SH7	.35	80	.39
3AP1	4.85	215A	.65	812	2.79	8005	4.75	VR105	.79	3A4	.87	6S7	.89	12SJ7	.49	81	1.29
3B22	2.69	217C	9.95	812H	6.90	8011	.69	VR150	.55	3A5	.99	6SA7	.44	12SK7	.57	82	.87
3B23	4.85	218	47.50	813	7.75	8012	1.47	VT127	2.25	3B7	.35	6SC7	.59	12SL7	.59	83	.72
3B24	1.59	221A	1.95	814	2.75	8013A	1.45	VU111	.59	3D6	.35	6SD7GT	.69	12SN7	.52	83V	.89
3B25	4.87	225	8.70	815	2.45	8014A	22.50	WL468	7.95	3Q4	.59	6SF5	.49	12SQ7	.49	84/6Z4	.63
3B26	1.79	227A	2.95	815	2.45	8016	1.25	WL530	17.50	3Q5GT	.67	6SF7	.59	12SR7	.49	85	.69
3B27	3.85	231D	1.25	816	1.10	8020	3.25	WL531	7.95	3S4	.67	6SG7	.59	12Z3	.79	89Y	.39
3BP1	2.95	249B	2.49	826	.42	8025	4.95	WL532	3.50	5R4GY	1.10	6SH7	.49	14A4	.79	117L7/M7	1.29
3C21	5.95	249C	2.89	829B	7.45	9001	.37	WL538	.69	5T4	.89	6SJ7	.57	14A7	.69	117N7	1.37
3C22	39.50	250R	7.45	830B	3.49	9002	.34	WL578	1.95	5U4G	.57	6SK7GT	.55	14B6	.67	117P7	1.27
3C23	2.47	250TH	18.95	832A	4.25	9003	.37	WL616	87.50	5V4G	.89	6SL7GT	.65	14F7	.69	117Z3	.57
3C24	.45	250TL	18.95	833A	32.50	9004	.37	WL619	19.95	5W4	.79	6SN6GT	.97	14F8	.89	117Z6	.65
3C30	.49	274B	1.19	834	5.75	9005	1.95	WX3245	49.50	5X4G	.59	6SN7GT	.65	14H7	.65		
3C31	3.49	282B	9.75	836A	.99	9006	.24	OA2	1.57	5Y3GT	.37	6SQ7	.45	14N7	.89		
3CP1	2.67	294A	4.57	837	1.69	C5B	7.95	OA4G	.95	5Y4G	.49	6SR7GT	.57	14Q7	.67		
3D21A	1.49	304TH	4.95	838	3.25	C6A	8.45	OB2	1.75	5Z3	.49	6SS7	.59	14R7	.67		
3DP1	1.97	304TL	1.39	841	.49	C6J	4.95	OZ4	.57	5Z4	.79	6T7G	.98	15	.89		

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.5mfd.	600v	.37	4mfd.	2800v	3.77
1mfd.	600v	.37	8mfd.	2000v	3.47
2mfd.	600v	.37	15mfd.	2000v	4.97
4mfd.	600v	.57	4mfd.	2500v	3.97
8mfd.	600v	1.07	2mfd.	2500v	2.37
10mfd.	600v	1.17	.1mfd.	2500v	1.27
3x.1mfd.	1000v	.47	.25mfd.	2500v	1.47
.25mfd.	1000v	.47	.5mfd.	2500v	1.77
1mfd.	1000v	.57	.05mfd.	3000v	1.97
2mfd.	1000v	.67	.25mfd.	3000v	2.67
4mfd.	1000v	.87	1mfd.	3000v	2.87
8mfd.	1000v	1.37	12mfd.	3000v	6.97
10mfd.	1000v	2.07	2mfd.	4000v	4.87
15mfd.	1000v	2.27	1mfd.	5000v	4.97
20mfd.	1000v	2.97	.1mfd.	7000v	2.97
24mfd.	1500v	5.27	3mfd.	4000v	5.37
.1mfd.	1750v	.87	2mfd.	3000v	3.47
.1mfd.	2000v	.97	2mfd.	4000v	3.27
.25mfd.	2000v	1.07	2x.1mfd.	7000v	3.27
.5mfd.	2000v	1.17	.02mfd.	12000v	9.97

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3000mfd.	25v	2.47	4x10mfd.	400v	.87
2x1250mfd.	10v	1.27	4000mfd.	18v	1.97
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1700v @ 4 ma; 6.3v @ 1A; 2½v @ 2A	4.98
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525-0-525v @ 60 ma; 925v @ 10 ma; 2x5v @ 3A; 6.3v @ 3.6A; 6.3v @ 2A; 6.3v @ 1A	6.97
500-0-500v @ 175ma	4.95
500-0-500v @ 25 ma; 262-0-262v @ 55 ma; 6.3v @ 1A; 2x5v @ 2A	4.45
425-0-425v @ 75 ma; 5v @ 3A; 6.3v @ 1.5A	3.98
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up to 18v AC	up to	12v DC	15 Amp.	11.57
up to 18v AC	up to	12v DC	30 Amp.	22.57
up to 36v AC	up to	28v DC	1 Amp.	3.47
up to 36v AC	up to	28v DC	5 Amp.	8.57
up to 36v AC	up to	28v DC	10 Amp.	14.57
up to 36v AC	up to	28v DC	15 Amp.	22.27
up to 115v AC	up to	100v DC	.25 Amp.	2.57
up to 115v AC	up to	100v DC	.6 Amp.	5.27
up to 115v AC	up to	100v DC	5 Amp.	22.57
up to 115v AC	up to	100v DC	3 Amp.	17.97

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15 hy @ 70 ma.	1.17	10 hy @ 250 ma.	2.47
12 hy @ 150 ma.	3.47	10 hy @ 200 ma.	1.98
25 hy @ 65 ma.	1.37	10/20 @ 85 ma.	1.57
.05 hy @ 15 amps	7.97	15 hy @ 125 ma.	1.47
.1 hy @ 5 amps.	6.97	15 hy @ 100 ma.	1.37
4 hy @ 600 ma.	5.97	3 hy @ 50 ma.	.27
200 hy @ 10 ma.	3.47	30 hy Dual @ 20 ma.	1.47
600 hy @ 3 ma	3.17	3/30 hy @ 250 ma.	3.47
325 hy @ 3 ma	3.47		

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8	25	50	108	170	250	600
10	30	56	125	175	350	6800

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MID-AMERICA CO. Inc.
2412 S. Michigan Avenue
Chicago 16, Ill.

Rhombic Antennas

(*Continued from page* 63)

channel. (This will result in an undesirable effect called "periodicity.")

An open wire line constructed as above will have a surge impedance of from 450 to 500 ohms, or somewhat above the standard 300 ohm receiver input impedance. However, this is nothing to worry about, because as the impedance of the line is raised, and the match becomes worse at the set end, the match improves at the antenna end of the line. As a result, it is possible to employ a 450-500 ohm line without running into transmission line ghosts, loss of picture detail, or increased loss due to impedance mismatch.

Two examples of the improvement to be expected over 300 ohm ribbon used under unfavorable conditions can be cited. Substituting an open line for 160 feet of ribbon exposed to beach weather for four months resulted in an increase on two low band channels of more than 10 db. After six months the performance of the open wire line had not deteriorated enough to notice.

In another case an open line was substituted for 1100 feet of 300 ohm ribbon newly installed and not providing adequate signal strength. The location was not near the ocean. The measured increase in signal at the receiver on Channel 5 was approximately 12 db. (measured in dry weather), a very worthwhile gain. Wet weather proved to have little effect upon the performance of the open line, which is more than could be said for the ribbon line. It should be kept in mind, however, that for a comparatively short run not near the ocean, ribbon or tubular 300 ohm line is entirely satisfactory.

Where noise pickup by the line is not a serious problem, the same order of improvement will be obtained with an open wire line on the high band when the installation is near the ocean or the run is very long.

When expense must be kept down, plastic curlers of the type sold for use with home permanent wave kits may be used for spacers. Get the clear ones rather than the colored.

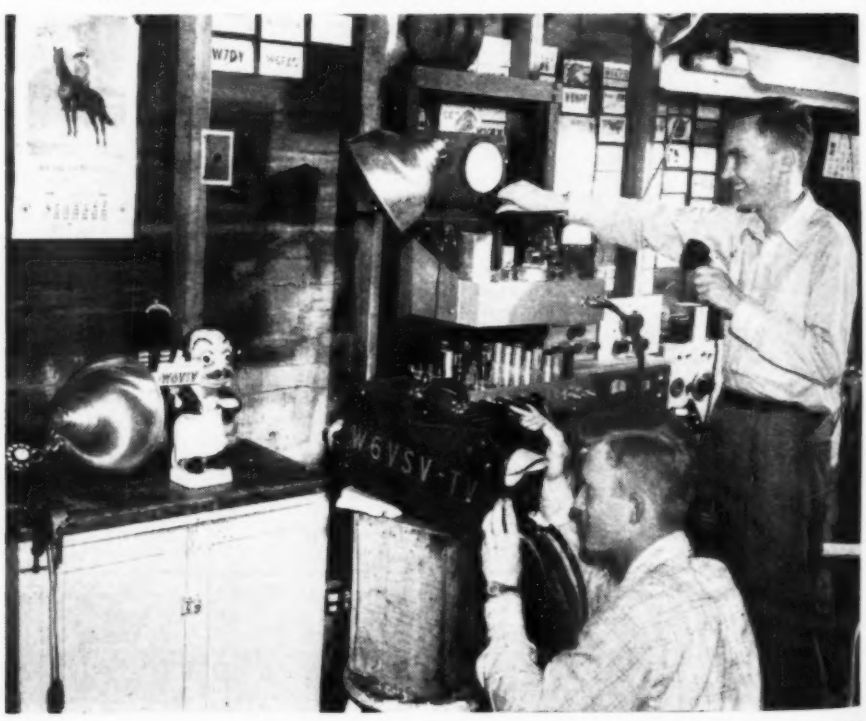
Somewhat more care must be taken with an open wire line to avoid sharp bends and to keep the line away from objects as much as possible. Nylon cord or fish line may be used to support and position the line where necessary. The feed line in any case should leave the antenna symmetrically for at least six feet on the high band or at least fifteen feet on the low band before making a bend to the right or left. Contrary to popular belief, little if any reduction in noise pickup will be realized by twisting or transposing the line.

Construction Pointers

It is recommended that wood poles be used to support the array unless they are spaced several feet from the apices. Guy wires should be well broken up where they run within a few feet of the antenna, or else rope guys should be used. All joints should be soldered.

—30—

First amateur televiser in the San Francisco Bay area is 23-year-old Bob Melvin, who built a TV camera and control system in less than one month. Entire cost was less than $200.00. On the air practically every night between 8 and 10 p.m., he is assisted by Don Melvin, shown here at left training the camera on "Rudy," a small waiter's figure carrying the station's call letters as a test pattern, while Bob (right) monitors the image and talks accompanying sound effects into the microphone.



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International Short-Wave
(*Continued from page* 69)

system for Europe and another for the West Coast of North America for the purpose of concentrating radiated energy more sharply to those regions. In either case, the frequency of 11.795 may be used also, while 6.045 may be employed for the transmissions to South East Asia and Northern Australia.

Following experimental transmissions—which should be under way by now, the "K. 100" will be put into regular daily use, according to Mr. Stuart.

Our congratulations go to *Radio Indonesia* and to its capable staff.

* * *

Brazil Data

Direct from Jair Picaluga, provisionary administrative director, *Radio Nacional*, Rio de Janeiro, Brazil, comes this information:

"PRL-7, PRL-8, and PRL-9 use 50 kw., and the transmitters are *RCA*. They are equipped with uni-directional, non-directional, and directed antennas. The towers are 180 meters in height, and the antennas are of the curtain type.

"All the material of our radio system is *RCA*, except a transmitter of 20 kw. used as reserve which is a *Philips*.

"PRL-8, 11.720 (25.60 m.); PRL-7, 9.720 (30.86 m.), and PRL-9, 17.850 (16.81 m.) comprise *Radio Nacional* s.w. transmitters. PRL-9 is still being tested and regular transmissions are expected to be set up soon.

"The station owns seven studios and a large auditorium. Each studio is equipped with the material necessary to give excellent performance. Microphones are *RCA* Model 44 ribbon type. We also have recording equipment which is used for taking down principal events all over Rio de Janeiro. This equipment is of the electro-magnetic kind. Its great advantage is its light weight, allowing it to lie easily mounted even in the streets. It is used chiefly by our News Department. Right now we are planning to establish a new system of transmissions of our News Department by means of portable transmitters of 7 kw. and 1 kw. The materials for this service already have been purchased, and we hope soon to put it to use.

"Presently, we are reorganizing our department of 'exclusive' recordings. We have special arrangements with out best musicians for making these 'exclusive' records right here at *Radio Nacional*, and they are not performed in commercial recordings. The greatest part of the music we broadcast is 'exclusive.' In addition, *Radio Nacional* is constantly renewing its cast with artists of Brazil and other countries. For instance, we already had under contract Carlos Ramirez, Pedro Vargas, Ana Maria Gonzales, Jose Iturbi, Irmas Meireles, Gregorio Barrios, Alberto Ribeiro, and many others. So you see that we are always trying to give the best to our listeners. This is our chief purpose."

Mr. Picaluga stated that reports are welcomed. Printed schedules (in *English*) listed PRL-7, 9.720, on the air daily 1135-2235, and PRL-8, 11.72, on the air every day *except Saturdays and Sundays* at 2130 (*now moved to 2200*) with the *"Hello, America"* program, spoken in *English*.

On the sheet was this notation—"We beg our listeners to send us reports of reception which will be confirmed by our verification cards."

(The chimes on the *"Hello, America"* program play the theme of one of Brazil's most popular compositions, "Luar Do Sertao," by Catulo da Paixao Cearense.—*Radio Nacional* via Bellington, N. Y.)

Our congratulations go to *Radio Nacional* and its staff for the splendid programs now being sent out in *English* as well as in Portuguese. *English-speaking* DX-ers are delighted with the fact that more and more Latin American nations are inaugurating broadcasts in *English* in addition to other languages. It is certainly a forward step!

* * *

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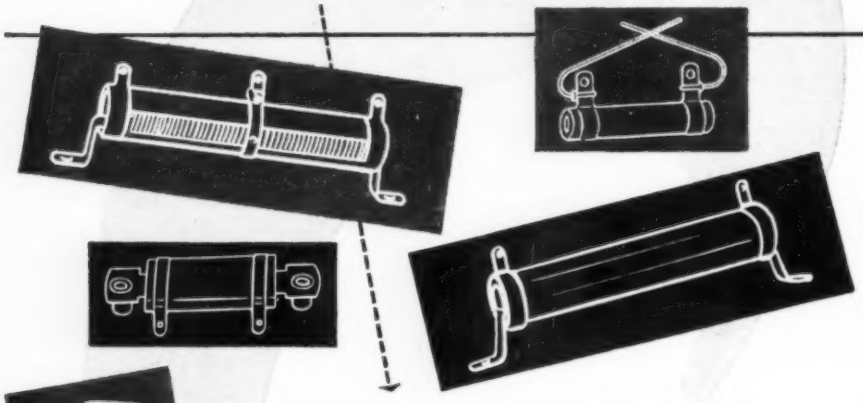

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6-VOLT DYNAMOTOR SCOOP! CARTER "MAGMOTORS" — Perm Magnets Extremely Hi-Eff. Compact 5½x3¾x4¼. Lo-Temp Rise.
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Both Units Above, SPECIAL $12.49

2 TO 4 WATT AMPLIFIER
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2 Tubes & 45mf 115v 60 cyc Output; 2.5 vct/10A / 10 KVinsP LUS sckts. **$5.95**
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Less Tubes, &Dyn. **98c**
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NEW 1KWHF RF 1.5to7mc's ConvertibleHiFreqsPi Net Adj 1N&OUT Csd 15 X 15 x 23" Rack Mtg Ribbon Coil, 240 mmf 7000V cndsr, RF mtr, Insitrs, Tech Manual, Matches Most Ants. BRAND NEW Coil Dmgd: Worth 10 times PriceforPartsAlone **$8.95**

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Serviceable—**LessTubes.**
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Ideal for Car or Boat, Neon Bulb Flashes Brilliantly in Dark, Four Yr. Life w/observicing. Less Batt **98c**
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250VDC 50Ma&Filter **$2.98**
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Comb hi-gain Dyn MikeXfmr UTC/Super Elec 3wdg, 600 ohmCT & 4000 ohms Tapped 250 & 150 ohms. Fully Shielded H'sld PLUS Exc Fidelity Dyn Mike. Both for ONLY **$1.49**

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OIL—1mf 500wvGE **4 98c**
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.025mf/1500wv **2 98c**
2x5mf/10mf) OILMITEto WE specs Rated 400wvdc—65to +65°C GTD usable 6000wvdc 2 for GTD usable 6000wvdc **98c**
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MICA .01mf/600wv TOBE DP 12 for **98c**

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6000mf/15vac **98c**
15mf/300v..7 for **98c**
50mf/350v "FP" 5 for **98c**
30-15-10mf/250wv .5/**.98**
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TUBULARS—Paper
.009mf/600wv 20 for **$0.98**
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5MaTuning2½"GE **$0.98**
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Dyn/Carbon Mike or Line Inpt. Aud Driver PP/G & Monitor Tube. Less Tubes **$4.50**
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SHARP CUT-OFF HIQ Cased and Shielded 60, 90, 150 cycles. Each **$2.25**; 3 for **$5.95**. UTC 854 cycles to 1025 cys. 1250 cys. Each **$1.95**; 3 for **$4.50.**

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10W, to 10Kc. Matches ANY Line or Spkr sw/VC's thu 4 or 15 ohms to ANY Load&Tube IMP bet 50 & 10240 ohms. Over 1000 combinations! Also EXC BandPassFiltr or FreqAtten Unit for DynMike. Cuts HI'sor Lows. IDEAL. Lazy Q-5actionCWorPhone. Gets ONLY Signal you WANT to hear. W/data **$1.39**

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OB2	$ 1.69	2K28	$24.89	6K8	$ 0.86	20	$ 1.17	394A	$ 3.75	1626	$ 0.35
OZ4	.87	2K29	24.95	6L5G	.98	PJ21	4.98	FP400	7.98	1629	.26
O1A	.45	2K39	$4.00	6L6	.98	REL21	4.85	417A	19.95	1633	.97
1A3	.59	2V3G	1.05	6L7	.83	RX21	3.20	GL434	3.45	1635	.90
1A4	1.26	2X2	.27	6N7GT	.90	PJ22/CE1C	1.49	446A/2C40	1.17	1641/RK60	.68
1A5GT	.70	3A4	.36	6P5G	.81	24G/3C24	.45	450TH	17.75	2050	.63
1A6	1.26	3A5	1.20	605G/884	1.27	25A6	1.04	450TL	39.95	2051	.42
1A7GT	.69	3B7/1291	.95	6Q7	.75	25B6	1.49	GL451	1.90	UX6653	.69
1B3/8016	.81	3B22	2.65	6R7G	1.05	25L6GT	.55	460/HF200	11.98	8012A	1.45
1B21/471A	2.95	3B24	1.85	6S7G	.81	25Y5	1.08	WL468	7.49	8013A	2.50
1B22	4.95	3B25	4.95	6SA7GT	.79	25Z5	.46	RH507	7.49	8020	1.50
1B24	4.85	3B28	5.89	6SA7GT	.45	25Z6GT	.55	527	7.49	9001	.34
1B26	4.50	3C23	2.48	6SB7Y	.81	FG27A	9.50	530	4.90	9002	.30
1B27	4.75	3C31/C1B	1.98	6SC7	.65	28D7	.36	531	1.80	9003	.35
1B29	3.39	3C45	24.95	6SD7GT	.45	30	.36	W1531	1.95	9004	.27
1B32	3.24	3D6/1299	.85	6SF5	.55	31	.36	534	2.45	9006	.18
1B37	45.00	3D21A	1.37	6SF7	.78	32	.99	GL534/1S21	1.95	**C'RAY TUBES**	
1B38	37.00	3D22	7.49	6SG7	.63	FG32	4.98	544	4.98	2AP1	3.79
1B40	29.95	3E29/829B	4.89	6SH7	.38	32L7GT	.95	GL546	1.69	2AP1A	4.85
1B41	49.95	3Q4	.54	6SJ7GT	.55	FG33	5.49	WL619	20.00	3AP1	4.75
1B54	49.95	3Q5	.89	6SK7GT	.45	35A5	.65	KU627	7.49	3BP1	2.98
1B56	49.95	3S4	.79	6SL7GT	.55	35B5	.59	701P1/SN4	3.98	3BP1A	7.98
1B60	29.95	3V4	.69	6SN7GT	.55	35C5	.60	W1632A	8.98	3CP1	2.65
1C5	.86	4A1	1.29	6SQ7GT	.47	REL36/6J4	.75	701A	3.50	3CP1-S1	1.95
1C6	1.26	4H27/201	2.49	6SR7	.63	35L6GT	.54	702A/702B	3.70	3DP1	1.87
1C7G	1.27	4H31	18.95	6ST7	1.19	35W4	.42	703A	2.79	3EP1	2.75
1D5GP	1.25	4C33	81.00	6T8	.98	35Y4	.55	704A	1.08	3FP1	1.49
1E5	1.38	4C35	22.95	6U5/6G5	.72	35Z5GT	.41	705A/8021	1.05	3AP1	4.75
1E7G	1.17	4D32	7.98	6U6GT	.54	36	.36	707B	7.98	3BP1	2.98
1F4G	1.05	4J32	95.00	6V6GT	.65	38	.34	710A/8011	.85	3BP1A	7.98
1F7GY	1.55	4J42/700A	95.00	6W6G	.87	39/44	.25	713A	1.49	3CP1	2.65
1G4GT	1.05	4J47	29.85	6X4	.45	CRC40	.54	715B	7.29	3CP1-S1	1.95
1G6GT	.98	4T1/2	45.00	6X5GT	.55	41	.61	717A	.61	3DP1	1.87
1H4G	.87	5C22	9.95	6Y6G	.87	45	.57	721A	1.89	3EP1	2.75
1H5G	.65	5C30/C5B	29.95	6Z7G	1.21	45S/VT52	.27	723A/287A	9.95	3FP1	1.49
1H6G	1.27	5D21	9.98	6ZY5G	.46	46	.65	723A	8.98	3HP7	3.49
1H6G	1.27	5J23	25.95	7A4/XXL	.87	48	1.20	723A/B	14.95	4AP10	5.90
1L4	.69	5J29	14.25	7A5	.57	50	1.49	724A/B	3.90	5BP1	1.85
1LA4GT	1.05	5J30	17.39	7A6	.70	EF50	.40	725A	9.36	5CP1	1.75
1LB4	1.05	5R4GY	49.27	7A7	.69	50B5	.54	726A	6.90	5CP7	7.50
1LC6	.85	5T4	1.12	7A8	.69	50C5	.59	730A	10.90	5FP5	6.49
1LE3GT	.96	5U4G	.96	7AG7	.52	50L6	.56	803	4.75	5HP1	2.49
1LH4	1.05	5V4	.52	7B4	.95	53A	.89	804	6.90	5HP1	4.95
1LN5	.75	5W4	.95	7B5	.87	RK65	22.98	805	3.80	5JP2	10.95
1N5GT	.69	5X4G	.71	7B6	.70	FG67	12.75	807	1.10	5LP1	11.00
1P5GT	.69	5Y3GT	.38	7B8	.70	70L7GT	1.15	808	1.35	5LP1	14.00
1P24	.85	5Z3	.81	7C5/1203A	.36	72	.95	809	2.40	5LP1	18.00
1Q5GT	.96	5Z4	.88	7C5	.56	CRD72	1.85	810	6.45	5MP1	3.95
1Q26	75.00	6A4	8.35	7C6	.69	CRP72	1.37	811	1.67	6BP7	4.65
1R4/1294	.98	6A3	.98	7C7	.65	73	1.67	812	2.60	6FP7	12.75
1R5	.59	6A4	1.29	7C23	69.50	NR74	.29	813	6.25	6HP7	5.95
1S4	.49	6A6	1.02	7E5/1201	.99	75	.56	814	2.61	6GP7	12.33
1S5	.54	6A7/1853	1.08	7E6	.69	VR75	.56	815	1.39	9LP7	2.21
1T4	.54	6AC5	1.08	7E7	.85	76	.45	826	.42	12DP7	1.49
1T5GT	1.05	6AC7	.75	7F7	.67	77	.45	SD898	3.98	12GP7	12.80
1U4	.69	6AD6	.81	7G7	1.03	78	.45	829B	4.89	12LP4	34.00
1V	.87	6AD7	1.17	7H7	.65	80	1.29	832	3.98	16AP4	55.00
1Z2	1.98	6AF6G	.87	7K7	1.05	81	1.29	832A	4.20	902	3.75
2A3	1.25	6AG5	.75	7L7	.86	FG81A	4.45	836	.95	905	3.89
2A4G	1.08	6AG7	1.08	7N7	.85	82	.85	837	2.35	912	89.98
2A5	.86	6AH6	.75	7Q7	.72	83	.85	838	2.79	**TUNGAR**	
2B6	1.05	6AJ5	.85	7V7	1.04	83V	1.05	842	2.75	12X825	2.25
2B7	.85	6AK5	.78	7Y4	.69	84/6Z4	.57	843	.39	20X672	2.95
2B22/GL559	.73	6AK6	.81	10Y	.60	85	.57	845	4.15	1800486GE	3.49
2C21/1642	.81	6AL5	.63	12A6	.18	807	.36	851	14.95	1996698	2.95
2C22/7193	.18	6AL7	1.00	12A7	.96	VR90	.67	860	1.62	2898881	2.50
2C26	.25	6AQ5	.63	12A8GT	.56	VR92	.23	861	10.26	8504883	3.98
2C34/RK34	.65	6AS5	.59	12AH7GT	.46	FG104	14.98	864	.45	**MAZDA PILOTS**	
2C39	18.00	6AS7G	4.68	12AT6	.45	FG105	10.75	865	.99	44 Box 10	.50
2C40	2.88	6AT6	.45	12AT7	.79	VR105	.63	866A	.99	49 Box 10	.60
2C43/464A	8.81	6AU6	.63	12AU6	.59	HY114B	.81	866Jr	1.00	55 Box 10	.50
2C46	1.69	6BA6	.96	12AU7	.79	HY115/145	.80	868/PJ23	1.90	64 Each	.07
2C51	.98	6BE6	.59	12AV7	.89	117N7GT	1.36	869	30.00	80/T4 Ea.	.09
2D21	.90	6BF6	.59	12BA6	.56	117Z3	.49	872A	1.49	100W/20V	.25
2E5	.86	6BG6G	1.49	12BA7	.89	117Z6GT	.77	874	.55	313/28V.	.15
2E22	1.34	6BH6	.79	12BD6	.45	117Z7GT	1.49	876	.36	323/3V	.10
2E24	2.98	6BJ6	.59	12C8	.35	FG117A	16.25	878	1.95	Sylvania 86/6W/120V	.18
2E25/HY65	2.98	6BL7	.59	12H6	.34	VR150	.49	884/6Q5G	1.27	W-stghs C7/7W/120V	.09
2J21	11.98	6C5	.47	12J5GT	.35	VT158	9.85	885	.95	**NEON BULBS**	
2J21A	11.98	6C6G	.55	12J7GT	.75	FG166	49.00	920	2.70	NE2 100/ **$ 3.98**	
2J22	29.95	6C8G	1.05	12K8	.75	FG172	29.50	921	1.19	NE16/991	.25
2J25	34.95	6D6	23.95	12L8	1.49	FG190	12.98	923	.85	NE45/14W	.24
2J26	8.89	6E5	.45	12Q7GT	.55	205B/VT2	1.98	927/CE25	1.26	**DIALCO** type Bull's Eye Pilot Lite Complete w/86 115V bulb or neon bulb **2/.98**	
2J27	8.83	6F5	.81	12SA7GT	.55	211/VT4C	.45	930	.75		
2J31	9.95	6K6	1.05	12SC7	.55	RX215	9.95	931A	3.95		
2J32	39.95	6F6G	.59	12SF7	.56	WE215A	.25	954	.14	**BALLAST**	
2J33	14.50	6F8G	1.04	12SH7	.34	217A	3.98	955	.16	1P1	.49
2J34	23.98	6G6G	1.05	12SJ7GT	.46	GL227A	2.90	956	.27	6-11	.49
2J37	17.25	6H6	.43	12SK7GT	.55	231	1.24	957	.27	7H12	.49
2J38	13.89	6H6GT	.38	12SN7GT	.54	250TH	18.49	958	.25	9-3	.49
2J39	34.00	6J5	4.75	12SQ7GT	.54	250TL	18.90	SD968	4.98	10-4B	.49
2J47	39.95	6J4	5.75	12SR7GT	.37	282B	6.49	991	.25	13-4	.49
2J48	45.00	6J5GT	.48	12X3	.90	304TH	5.95	1000UHF	59.95	20-4	.49
2J49	24.00	6J6	.78	12Z3	.72	304TL	1.39	CK1005	.18	K49A	.36
2J50	40.00	6J7	.75	14H6	.81	307A/RK75	3.90	1603/6C6	2.90	K55B	.36
2J53	40.00	6K5GT	.86	14R7	.85	316A	.38	1609	5.98	M55B	.39
2J56	81.00	6K6GT	.45	15E	1.44	327A	2.95	1613/6F6X	.55	K80B	.36
2J61	39.00	6K7G	.55	15R	.75	350	1.23	1614	1.42	WL121A	2.61
2J62	39.00			FG17	2.87	350B	1.98	1616	.89	NE51/NE20	.07
				19	1.49	371B	.84	1619	.18	**TEL Slidelamps** 6, 12, 24V 48, 55VEa.	.18
				19T8	.98	393A	3.80	1620	4.95	Tubes Gtd. Exc. Open Fil & Breakage "R" Tubes Gtd Only Via R'Exp.	
								1622	1.75		
								1624	1.69		
								1625	.37		

CONSTANT V'REG NEW RAYTHEON
Inpt: 95-130V/60cyc; Output: 115V 60Watts Csd **$10.95**
RAYTHEON ConstV'Reg Inpt: 198 to 242V, 50-60 cyc; Outpt: 220V, 500 Watts (0.5% Regltn Rack Mtg: **$36.00**
SOLA ConstV'Reg USN Csd Inpt: 95 to 190V/50-60 cyc; Outpt 115 V 2KW/17.4A/ConstDty 1% Reg LN **$130**; Same New **$369** USN **$162**
SOLA ConstV'Reg Inpt: 92to138V; Outpt: 115V 26.1A 3KVA. New **$185**
GEN ELEC ConstV'Reg Inpt: 95to130V 50-60cyc; Outpt 113/115/117V ..78KVA at .80PF. Used Gtd **$43.00**
BRAND NEW **$63.00**
GLYPTAL Cement 4 Jars **98c**
TG10/20W Amp less Tubes **$19.95**
CLOCK MOTOR Haydon Sync 6to10V AC/60cyc/24rpm w/Sw **98c**; 12/**$10.00**
CLOCK MOTOR HAYDON Sync 1RPM/115Vac **$2.49**
BUTTERFLY CNDSR 2½Mtr 30mmf w/RF Tank&Choke **75c**; 2/**$1.25**

XFMRS—115V 60 Cyc Inpt
Plate & Filament Xfmrs
1000VCT 200 Ma, 6V/5A, 5V/6A, 18V/.55A, 90VbiasTapCSD **$6.95**
880VCT 125Ma, 6.3VCT/3A, 5VCT/3A, 6.3VCT/2A Csd HVins Herm Sld Dtys, 250ma USN **$3.98**
700VCT 120Ma, 115V/100Ma, 6.3V/1A, 5V/2A, Csd HVins **$2.98**
650VCT 175Ma, 6.3V/1.2A, 5V/3A Csd HVins Jeff Stancor **$3.29**
500VCT 60Ma, 6.3V/4A USN Hi-Sld HVins **$2.49**
420VCT 85Ma, 6.3/V1.9A also Pri 6-12-24-115VDC&230VAC Univ Vib Xfmr Csd **$2.39**; 2/**$4.39**; 10/**$19.98**
Plate Transformers
6800V or VCT/1A 17KV 208 to 251 Vinpt **$59.50**
3400V or VCT/1A 17KV 107 to 126 Vinpt **$29.50**
10800VCT or 21000D blr @ 95 Ma Csd RAYTHEON **$19.95**
7500 or 15000V Dblr /35Ma **$18.95**
5000V/10Ma for 2X2) Csd **$7.95**
3000V/10Ma Csd HVins **$4.50**
2100V/10Ma STANCOR Csd HV **$3.98**
1800V 4Ma USN Csd HVins. **$3.29**
1200VCT/300Ma & 18V/1A wndg Csd HVins **$6.95**
2x330VCT/10Ma (or 660VCT/10Ma) Csd HVins **$1.49**

FILAMENT TRANSFORMERS
2.5V/1.75A, 4V/16A 20KV ins. Csd **$4.95**
2.5V/2A HVins 2X2, **69c**; 10/**$5.96**
5VCT/60A Kenyon HVins **$6.95**
5V.115A Kenyon HVins **$12.95**
6.3VCT/.7A USN CsdHVins **$1.39**
6.3VCT/4Aeiguo6.5Aiv, cdUSN **$1.69**
6.4V/12A, 6.4V/10.6A, 3x5V/3A 2.5V/1.75A Stancor Csd HVins UsableAsAutoFormer **$4.98**
12.6VCT/2A HVins **$1.49**; 2/**$2.79**
1-F XFMRS 456KcDoubleSlugTuned, Shielded, Ea. **39c**; 3 for **$1.00**
Telex & FM I-F Xfmr 10 to 14 Mc Double Slug Tuned Adjustable "Q" Shielded, Ea. **59c**; 2/**98c**

FILTER CHOKES
13.5Hy/1Amp/420ohm/17KV $54.00
15-29Hy/150Ma Csd **2.95**
12Hy/300Ma **3.95**
3Hy/40Ma .3 for **1.00**
3.5Hy/400Ma or 20Hy/300Ma 12KVinsul **7.95**
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Ideal CRT Xfmr 1800V Dblr Ckt; 115 VAC inpt; Outpt—900V/35ma, 2x2.5V/2A ea. Sect, 4KVins. SigC Specif. Herm Sld. Two 2X2 tubes & ALL FltrParts&Data **$5.98**

$3.00 Min. Order. F.O.B. N.Y.C. ADD Shpg. & 25% Deposit

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JFD produces over 4000 items for TV and radio servicing. Here are a few of our most recent developments. Typical JFD quality at mass production prices . . . with a good margin of profit for you.

JFD "Snap-On" Insulators New!

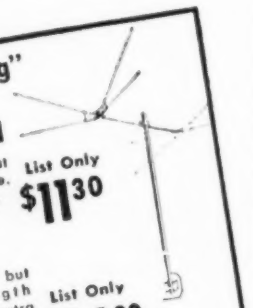
No other clamp like it. Snap . . . click . . . and it's on with a tight, spring steel grip. Polyethylene inserts for twin lead. Ask for No. SPT100 for 1" masts, and No. SPT125 for 1¼" masts. List 10c

"Drive-In" Insulators

Can be hammered in quickly and conveniently. No. NT100 for twin lead. No. NR100 for coaxial cable. List 6c

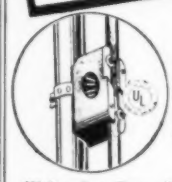
R60 "Quik-Rig" Ranger All-Band Conical

Top performance at rock-bottom price. Instant assembly. List Only $11.30



JFD R61

Same as R60 but ¼ wavelength stacked for extra gain needed in fringe and remote areas. List Only $24.00



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Underwriters Laboratories approved for indoor-outdoor use. Safeguards sensitive TV parts against lightning and static charges. List $2.25

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More than a catalog, it contains installation and servicing data of interest to every Serviceman.
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* * *

Lamphouse Annual

Cushen, N. Z., says the new 1950 edition of *Lamphouse Annual* will be ready for release by this time; he will be pleased to send copies to anyone; price is 30 cents in 5-cent stamps (please do *not* send *IRC*'s). The Annual contains extensive s.w. logs; Australasian *BCB* and complete North American *BCB* log (except 250 watt channels). *QRA* is Arthur Cushen, 212, Earn St., Invercargill, New Zealand.

* * *

Club Notes

Australia — The British Branch of the *Australian Correspondence & Exchange Club*, now in association with the *Koala of Australia*, is welcoming new members interested in radio and *DX* listening. All members entering will be listed (with their particular interests) in the club organ published every six weeks. While this club is primarily a stamp exchange directory, through the efforts of the publisher, Mr. Goldfinch, a radio column (edited by L. M. Harris of California) will soon be used in the house organ. Further details may be had by writing to the American representative, L. M. Harris, Route 1, Box 101, Winters, California.

England—Eric Good, Chief of the *Swedish DX Fan Club*, informs me that the club now has a membership of 162, of whom 139 are Swedes. Seven countries are now represented in this organization whose primary purpose is to foster world friendship and peace. (I was honored with Membership number one (W-1) in the United States.—K.R.B.) Members are welcomed from anywhere in the world, and Eric extends a special invitation to America s.w. listeners (*both SWBC and hams*) to membership. He is eager to have a representative for each State in the U. S. Membership is free to all, but return postage in the form of one *IRC* will be welcomed. Many projects are planned by the group, including several special *DX* broadcasts from stations throughout the world. One of these *DX* sessions is scheduled from *Radio Saigon*, 11.78, 6.165, on December 13; exact time will be announced well in advance by *Radio Sweden* in the "*Swedish DX-ers Calling*" session. Editor of the club's house organ, *DX-Fan News*, is Bertil Falk, Sweden. Mr. Good's *QRA* is 5, Aldred Street, Worksop, Notts., England.

Direct from A. W. H. Wennell, Hon. Gen. Secretary, *British Short-Wave League*, 145, Uxendon Hill, Wembley Park, Middlesex, England, comes this notice—"In the interests of all concerned, the Council and Management of the League are of the opinion that a complete reorganization of the League is most necessary. Members, therefore, are hereby notified that the League's activities, including the publication of '*Short Wave Review*,' must be temporarily suspended. The reorganization is expected to take some six to eight weeks and all members will be informed when same is complete. In the meantime, please accept our best 73's and sincere thanks for your continued support."

New Zealand—New officers for the coming year of the *New Zealand DX Club, Inc.*, are—S. G. Bennett, president; A. Gunn, vice-president; H. J. Barr, secretary. The executive committee includes G. S. Connelly, D. B. Gate, Keith A. Robinson, N. Barrett, G. Clark, and S. Gordon. Station address service is in charge of M. Allison. Monthly house organ is "*NZ DX-TRA*," and *QRA* of club headquarters is 10, Koraha St., Remuera, Auckland, New Zealand.

* * *

Verification Data

Radio Norway is sending out a new type of card. (Peddle, Newfoundland)

XEWW, 9.500, Mexico City, verified in 10 days, giving *QRA* of *Cadena Radiodifusora Mexicana*, S. A., Calle Ayuntamiento 54, Mexico, D. F. (Slutter, Pa.)

TFJ, 12.175, Reykjavik, Iceland, recently verified. (Peddle, Newfoundland)

Radio Ceylon still verifies on old SEAC sheet with "SEAC" crossed out. (Osterman, N.Y.)

ZAA, 7.852, requests reports to *Radio Tirana*, Tirana, Albania. (ISWC)

Verie-letter received from CHNX, 6.130; power listed 500 watts; is operated by *The Maritime Broadcasting Co., Ltd.*, P.O. Box 400, Halifax, Nova Scotia, Canada. (Smith, Ala.)

* * *

This Month's Schedules

Aden—The Broadcaster, Perth, Western Australia, says "ZNR, 6.76[illegible] can be picked up easily" at 1115; this one is officially listed on 6.765 as Cable & Wireless (N.E.), Ltd., at Aden. Bas Boradli and as *inactive. Has it been brought into broadcast use?*

Albania—ZAA, *Radio Tirana*, is scheduled to North America on 15.640 at 0700-0730 with news and program (presumably all-Albanian); *has anyone heard this transmission?* Is listed with 3 kw. power.

Anglo-Egyptian Sudan—After having "disappeared" for some time, *Radio Omdurman* recently was noted back on 9.747 with its daily 2315-234[illegible] program (all-Arabic). (Stark, Texas) Is heard afternoons also in Europe.

Angola—Radio Club de Benguel[illegible] sent *QSL* card for reception of CR6RB, 9.165; schedule given 0615-0700, 1230-1400 on 9.165, 7.04[illegible]

Argentina — Schedules printed in the various languages used in the SRE (International) Program from Buenos Aires outlets are being widely distributed. Also being sent (probably in lieu of *QSL* card) is a triangular dark-blue pennant bearing name and call of station heard, together with a

READY NOW! New 1950 Walter Ashe CATALOG

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. . . for Industry • Schools • Homes
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Amazing RADIOSONDE Weather Transmitter... Type AN/AMQ-1

Ideal for Electrical Engineering, Physics and Chemistry students, Hobbyists, Experimenters, Amateurs, etc.

Designed to be attached to a balloon and released by U. S. Government weather stations for descent by parachute, this electronic wonder records temperature, barometric pressure and humidity in the high altitudes and relays the findings via radio. Contains miniature 72 MC (approx.) Transmitter, Temperature Sensitive Resistance Element, Humidity Sensitive Strip and Barometer. Complete with 3 A 5 or 1 B 6 GT/NB tube Sensitive Relay and Temperature-Humidity Chart. In original packing.

Formerly sold for $3.95 up to $7.95

NOW ONLY **$1.95** each

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Walter Ashe Radio Co., R-49-10
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☐ Rush my FREE copy of New 160 page Catalog.
☐ Enter my order and ship same day ..... type AN/AMQ-1 RADIOSONDE @ $1.95 each, *quantity* plus 30c (each) to cover packing and postage.
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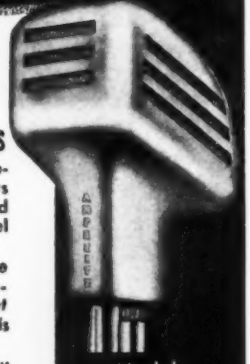

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"The ultimate in microphone quality," says Evan Rushing, sound engineer of the Hotel New Yorker.

- *Shout right into the new Amperite Microphone—or stand 2 feet away—reproduction is always perfect.*
- *Not affected by any climatic conditions.*
- *Guaranteed to withstand severe "knocking around."*

Models
RBLG—200 ohms
RBHG—Hi-imp.
List $42.00

"Kontak" Mikes
Model *SKH*, list $12.00
Model *KKH*, list $18.00

Special Offer: Write for Special Introductory Offer, and 4-page illustrated folder

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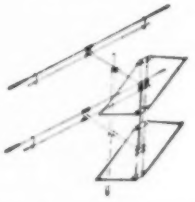
Introducing the new SHORE DIAMOND ANTENNA



- ★ Stacked array offers high DB gain on both bands.
- ★ High signal to noise ratio.
- ★ Channels 2 to 13 plus FM.
- ★ For use with 72, 150 or 300 ohm transmission line.
- ★ U-Bolt clamp provided to facilitate proper spacing and independent orientation of each bay.
- ★ No loose ends to become victims of adverse weather conditions.

Fast assembly—easy to mount.

Net weight—8½ lbs.
Shipping weight—9½ lbs.
No. RW102 (single diamond) $16.90 list
No. RW104 (as illustrated with ¼ wave transformer) . . . . . $33.80 list

Write for Details

SHORE ENGINEERING, Inc.
Box 325 Long Branch, N. J.

white and light-blue bullseye on pennant. Complete SRI schedules are currently listed — LRU, *Radio El Mundo*, 15.29, 2100-0100 in Spanish for Latin America; LRY, *Radio Belgrano*, 9.545, 1545-1645 in Spanish for Western Europe (Madrid-Rome); 1715-1745 in Italian for Western Europe (Rome-Genoa); 2115-0100 in *English* to Central and Eastern U.S.A.; LRS, *Radio Splendide*, 11.88, 1000-1300 in Portuguese for Sao Paulo and Rio de Janeiro; 1500-1600 in Spanish for Madrid; 1601-1730 in French for Western Europe (Paris-Brussels); 1731-2030 in *English* for Western Europe (London); 2030-2230 in Portuguese for Sao Paulo and Rio de Janeiro. This letter also is being sent out—"We were very pleased to receive your kind letter and beg you to excuse us for the delay in answering; we wish to thank you for the information and suggestions you were good enough to send us regarding the transmission and program from our short-wave station. . . . The International Broadcasting Service has as its aim to let people know what present-day Argentina is like, the development, the customs of its inhabitants, its work and expectations, its historical, scientific, and artistic background and all of the facts that will lead to a better understanding with other countries and to a sharing of mutual ideals. Naturally, as we wish to improve our service, we have noted your remarks which have proved so useful to us in our efforts to attain perfection. We should welcome any further reports that you care to make, particularly regarding our signal strength, quality of transmission, and program material. In this connection, and if it were not a presumption, we beg you to continue to collaborate with us in this broadcasting which exists solely by friendship and for friendship. Your continued comments will be very much appreciated, and we take the liberty of thanking you in advance.

"As a pleasant souvenir of the friendly relationship which has sprung from this correspondence, would you please accept the small pennant which we enclose. It is a momento of our broadcasting service. . . ." (Worris, N. Y.)

Australia—At the time this was being compiled, *Radio Australia* was to move from 11.76 to 11.85 for the 1643-1800 (to 1755 on Sat.) beam to Eastern North America; recently, the 11.76 channel has been *QRM'd* greatly by Moscow's Home Service which runs to 1800 on that frequency. If 11.85 proves unsatisfactory, *Radio Australia* will resume operation on 11.76 for this particular transmission.

A new layout has been effected for the Forces' broadcast (for relay by WLKS and WLKU in Japan) at 2158-2315, when stations now in use are VLA6, 15.20, VLB5, 21.54, VLC9, 17.84, VLG6, 15.32; on Sundays and Mondays (EST), the transmission begins 2100. (Hutchins, *Radio Australia*)

DIAL LIGHTS

½" Green Enclosed Type Chrome Finish. Min. bay base 59c
1" Red 115V Bulb Removable from front; Smooth Jewel bay base. Price 89c
1" Red Shutter Type, 115V. Removable From Front; Smooth Jewel Candelabra Base. Price 99c

FILTERS

LINE AND BAND PASS
LINE FILTER. GE 100 Amp Filter w 2x5Mfd 50V oil cond. Operates on 110VAC DC **$1.98**

IKW LINE FILTER. clean up BCI & TVI. Uses 4-.002Mfd Cond Easy to Mount **$3.95**

NOISE FILTER
SPRAGUE 115Vac 10 Amp. JX51E **98c**

BAND PASS FILT. 90 cy. & 150 cy. sharp cut off Hi Q @ Ea. **$2.25**

TIME DELAY RELAY
VACUUM 45 Sec. 117v 60 cy Metal Tube 4 Prong. Edison Price **$1.95**

GE Relay Herm. Sealed CR2791 5 prong 5 Amp. Cont. SPDT **$1.25**

ROTARY BEAM COUPLER

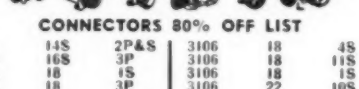
RF Coupler 360° rotation 1 turn coupling link. Plastic case mount on side Price **$2.95**

RECTIFIERS

KS 9020, 20 MA, Twenty 12V Discs, 13/8" Dia. Two stacks, one of 5 other 15 discs for TG30. Price $3.49
Rect. in 7.1VAC—Out 2.4V @ 3A Gal. 61289 Dual Sel. Price $1.49
Rect. Full Wave in 180 VAC, Out 120VDC 1A Price $3.49
Rect. 36V in 28V Out 1.5 Amp. $1.49
Rect. Dual Input 2.2V @ 1.5A; Out w 6.5V for SCR 593-BC728. Price $1.49

SOCKETS

8 Prong Cinch Steatite, 1 1/8" C.toC. 49c
7 Png. Steatite, 1 7/8" C.toC. 39c
5 Png. Wafer Socket, Mica Filled Socket for 705-715-5021 Steatite w. Lock 69c
7 Png. Wafer Min Tube 7/8" C.toC. 11c
8 Png. Octal Bake w. Mnt. 1 1/8" C.toC. 13c
8 Png. Octal Steatite w. Ref. Ring, 4 contacts 5c ea. 10 for 45c
Acorn Socket Steatite 5 ..... $1.00
Diheptal RCA 69c
8 Png. Loctal Amphenol w Mnt. 1 5/16" C.toC. 39c



CONNECTORS 80% OFF LIST

3102	14S	2P&S	3106	18	4S
3102	16S	3P	3106	18	11S
3102	18	1S	3106	18	1S
3102	18	3P	3106	22	10S
3102	18	4P	3106	24	7P
3102	20	1P	3106	28	1P
3102	20	4P&S	3106	28	2P&S
3102	22	17S	3106	28	4S
3100	28	2S	3106	28	12P
3106	10SL	4S	3108	16S	1P
3106	12	5S	3108	16S	4P
3106	14S	2P&S	3108	20	7S
3106	14S	5P&S	3108	20	11S
3106	18	5S	3108	20	17P
3106	14S	6S	3108	22	6P
3106	12S	3P	3108	22	8S

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MICROWAVE WRITE FOR FLYERS OF SURPLUS PLUMBING AND ACCESSORIES

RADIO-RADAR SETS

APS-15A	SO-13 (used)	QBG-1 (new)
SE (new)	SQ (used)	TBM (used)
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1.25-3-10 CM. Plumbing

WRITE FOR DATA OF MANY OTHERS

FILTER CHOKES

5 HY 40 MA	3 for $0.99;	20 HY 50 MA	$0.79
30 HY 25 MA	.79;	11.5 HY 90 MA	1.39
25 HY .065A	1.00;	6 HY 150 MA	.99
8.5 HY 125 MA	1.49;	25 HY 75 MA	1.25
1.75 HY 100 MA	.59;	.030 HY 2A	1.39
30 HY 20 MA	.98;	5 HY 150 MA	1.45
15 HY 100 MA	1.39;	Dual 7 HY 75 MA,	
2 HY 600 MA	1.95;	11 HY 60 MA	1.39
Swing 1.0/3.0 HY .225/.02 Amp, 1.75 HY 225 MA			2.25
.22 HY 600 MA .44 HY 400 MA			1.75
Dual 1.52 HY .167A	$1.95;	100 HY 1.4A	$1.95
Dual 120 HY 17 MA	2.49;	333 HY 1.12A	2.29
Dual 10 HY 150 MA	3.50;	1 HY 1 Amp	3.95
3.5 HY 500 MA	4.95;	20 HY 300 MA	7.95
10 HY 500 MA	12.95;	10 HY 450 MA	12.45
Swing 9-20 HY .525/.075 MA			14.95
6 HY 150 MA	$1.50;	2.5 HY 130 MA	$1.25
.116 HY 150 MA	4.25;	.01 HY 2.5A	1.45
.35 HY 350 MA	7.25;	5 HY 200 MA	1.45
Dual 2.2 HY 550 MA	9.95;	Write for List of others	

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2x110V	.010	6.3V/2.5, 2x2.5V/7	3.45
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2300V	.004	2.5V/2A	8.49
100VCT, 65V	.1	6.3VCT/10, 40V/1, 18VCT/1, 18-6/1, 6.3V/1	3.49
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Tapped @ 400V			6.95
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585	.086	5V/3, 6.3V/6	3.95
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600VCT	.155	6.3VCT/5, 5VCT/3	3.95
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215VCT	.300	5VCT/6	2.29

Plate Transformers—115V/50-60 cps input

Volts Out	Amp.	Each	Volts Out	Amp.	Each
65V	.500	$1.49	70V	1.	$1.95
500VCT & 650VCT	150-.015	3.00	100V	3.	1.95
2x150V	2x.940	4.25	1620VCT	.400	11.95
600VCT	.0165	2.49	246VCT	.880	3.95
250VCT	.077	4.95	121V	1.5	2.25
690V	450		126.5V	1.5	
1470VCT	1.2	24.00	132V	1.5	

Filament Transformers—115V/50-60 cps input

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230V 60 Cy	2.5V/6.5A	1.95
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220V 60 Cy	260V/.03A, 100V/1A, 6.3V/4.2	2.95
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220V 60 Cy	1V to 10V Tapped	2.95
220V 60 Cy	2x40V/.05 MA, 2x5V/6A, 12.6V/1A	2.95
220V 60 Cy	24V/.6A, 5V/3A, 2x6.3V/1A	2.29
43/78/90/115/180/230	2.5V/6.5A, 2.5V/6.5A, 6.3V/4A	3.95
110/115/120/125	6/12/18/24/75/100/115V 150 MA	2.49
230V 60 Cy	5V/9A HV INS	4.25
200V 60 Cy	700VCT/.08A, 110VCT/.08A 24V/.08A, 6.3V/.3, 6.3VCT/1A 5V/3, 5V/5A, 2.7V/5A	4.25
230V 60 Cy	400V/.03A, 190V/.03A, 5V/2.5A 5V/2.5A, W/2-866 Sockets	4.25
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MFD.	VOLT	MFD.	VOLT
30	250	40+40	150
40	200	40+20	150
40	300	20	450
2x20	20	10	300
20+10	150	10	200
30+30	25	8	450
40+40	25	40	250
40	400	40	150
50	200	40/20	150
2x10	150	25/40	25/200
2x20	25	2x40	150
30+15	150		

29c ea. 10 For $2.75

2x10	300		
225	15	20/20	350/25
20/20	350/25	20/30	250
2x30	150	30+20	150
30+20	150	10/20	450/100/50
10/50/100	450/100/50	15—15/20	350/25
15—15/40	150/25	25—25/10	25/350
20—20/10	50/400		

MFD.	VOLT	PRICE
2x90/20	200/50	$.79
150—20/8	25/50	.49
120—60-20	150/25	.49
3x20	450	.69
2x20/20	450/25	.39
20—8/25	450/25	.49
40—20/20	150/25	.69
40+10+10	450	.98
40/40/25	475/400/50	.59
40/20/25	450/50	.69
40/40/16	450/400/350	.89
4x20	450	1.10
2x30—15/20	400/25	.89
30—15—10/20	450/25	.89
3x10/10	450/25	.69
3x10/20	400/25	.69
80/40/150	400/80	1.10
2x80/60	250	.65
150—50—25	150	.49
20—10/80	450/50	.49
2x20/20	400/25	.59
40—20/20	400/25	.59
40—40/25	400/25	.59
40—10/80	450/150	.69
40—40—10	450	.69
40—30—10	450	.89
3x15—30	300	.69
2x30/20x10	450	1.10

MINICAPS PIGTAIL

MFD	VOLT	PRICE
30	450	$.49
30	300	.45
30	350	.48
40	450	.50
40	525	.70
16	350	.35
16	525	.45
16	450	.40
16	100	.24
20	25	.20
20	80	.25
20	450	.40
24	350	.30
8	400	.30
8	150	.15
10	150	.20
10	50	.15
4	50	.10
4	150	.14

DS TYPE CARDBOARD w/LONG PIGTAILS

MFD.	VOLT	PRICE
2x10	450	$.45
3x40	150	.65
20—20	150	.14
22—20	250	.45
30—30	150	.40
32—32	350	.49
30—30	150	.42
40—20	150	.42
32—32	250	.49
40—40	150	.42
32—16	450	.65
3x40/10	150	.98
80—40—30/100	150/25	1.59
8—8/25	450/75	1.40
30—20/20	450/25	1.40
20—16/10	200/25	.80
50—30	350	.55
2x5020	150/25	.69
8	450	.35
16	450	.40
20	150	.18
20	450	.40

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.5 MFD	25000 VDC	37.50	
1 MFD	25000 VDC	85.00	
.1 MFD	10000 VDC	15.00	
.06 MFD	15000 VDC	8.00	
.25 MFD	20000 VDC	17.50	
15 MFD	5000 VDC	27.50	
15 MFD	1000 VDC	2.25	
10 MFD	1000 VDC	1.95	
6 MFD	1500 VDC	2.25	

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New setup for the *DX* session each Sunday is 0025 on VLA8, 11.76, VLC9, 17.84, VLG6, 15.32, all to North American West Coast, and VLB5, 21.54, to Africa; at 0902, VLC7, 11.810, to North American Eastern, Central, and Mountain Zones, VLA6, 15.200, VLB3, 11.76, VLG6, 15.32, to British Isles and Europe and to Asia. (*Radio Australia*, via Walters, Ariz.)

Baleanic Islands—"*Emisora Radio Menorca*" or "*Aqui Radio Menorca*," or "*Transmite Radio Menorca*," at Mahon, heard R6-7 from sign-on 1400 on 7.545; opening tune, call, and "Viva Franco! Arriba Espana!" Plays mostly recordings, many vocal selections including operatic as well as typical Spanish type songs; usually signs off around 1530 but sometimes has been heard *after* 1600. More recently the frequency has been approximately 7.510. Full opening call apppears to be "Aqui Menorca, Emisora Radio Menorca, Delegacion Insular del Frente de Juventudos, Islas Baleanes," (Pearce, England)

Belgian Congo—OTM-1, 6.295, *Radio Congo Belge*, Leopoldville, noted opening 0000 with drums, good signal in New York. (Bellington) Ridgeway, South Africa, reports Leopoldville is now using 11.73 at 0500, French news 0530. Also that OTM-2 has moved to 9.400 from 9.380, heard to 1500, French and Flemish announcements *only*. Change of frequency confirmed by Balbi, Calif., and others. The 9.400 channel heard in Texas signing on 0000. (Stark) Is strong in New York at that time. (Bellington) Some time ago I ran across Leopoldville on about 11.645 at 0615 in French; fair level through the usual *CWQRM* on that spot.

Belgium—In a newscast, the *Swiss Radio* recently said that the *Belgian Radio* had placed orders with a Swiss company for *two* 100 kw. transmitters for s.w. use. (Worris, N. Y.)

Brazil—PSL, 7.937, PSH, 10.220, heard 1645-1700 in Newfoundland. (Peddle) PRL-9, 17.850, Rio de Janeiro, *Radio Nacional*, heard 1500-1800. (GDX-aren, Sweden) ZYC-8, 9.610, *Radio Tamoio* in Rio de Janeiro, noted 1945. (McPheeters, N. Y.) ZYK-3, 9.56, Recife, noted with *English* program, "Wake Up Brazil," daily 2030-2040. (Boice, Conn.)

ZYC-9, 15.37 (listed 15.375), Rio de Janeiro, heard around 2100. (Domzalski, Ill.) This is *Radio Tupi, not Radio Tamoio* as widely reported, although it is in a network with *Radio Tamoio*. Both are controlled by Diarios & Emissoras Associadas; all-Portuguese programs. Bellington, N. Y., reports ZYC-8, 9.61, with good signal 2050, only slight *QRM*. ZYN-7 15.165, Fortaleza, noted 1600 with *English* announcement.

Bulgaria—*Radio Sofia*, 7.671, has less potent signal lately with much *QRN* during the 1515-1530 news period. (Peddle, Newfoundland) Heard in New York 2315 with setting-up exercises, good signal despite slight *CWQRM*. (Bellington)

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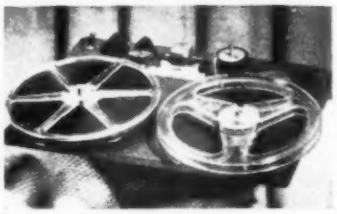

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Burma—Radio Rangoon, 6.035, has *English* 0915-1015; news 1000, and program preview just before closedown. (Ridgeway, South Africa)

Canada — VED, 8.266, Edmonton, Alberta, usually is fairly good around 0000 but through heavy *QRN;* announces program as coming from Trans-Canada Network; news follows. Balbi, Calif., hears this one 2200-0100 sign-off.

Canary Islands — EAJ43, 7.510, Santa Cruz, heard daily from 1600 sign-on to 1700 closedown; sometimes is a little late in signing on. (Pearce, England) Heard in Pennsylvania near 1700 through terrific *CWQRM*, very weak. (Slutter)

Cape Verde Island—Stephan, South Africa, reports *Radio Clube de Cabo Verde*, CR4AA, Praia, is broadcasting now on 5.880, same frequency used by Cape Town; CR4AA is on the air 1530-1700 and Stephan says this station can be referred to as "an entertainer of note." (Swedish DX broadcast)

Chile—CE920, 9.200, Punta Arenas, heard with fair signal when tuned 1912; woman announced at 1915 and they were still going strong when checked 2105. (Ferguson, N. C.)

China—Old XGOE heard in Australia on 9.86 at 0645 with Western music, then Chinese news; current callsign in use is not known. Nanking, 11.83, heard 0430 with Chinese news and music, poor signal; Nanking, 9.73, heard 0500 with music and Chinese news, only fair. (Sanderson)

Balbi, Calif., recently has heard Shanghai on 11.85 after 0530, nice signal; often identifies as Shanghai; does not seem to be in parallel with any of the other Communist-controlled outlets.

Colombia—HJFK, 6.103, Fereira, on nightly, identifies at 2120; all-Spanish. (Leinbach, N. Y.)

Cuba—Cocy, 11.74, Havana, heard opening 0625 with music and announcements in Spanish and then in *English;* strong in North Carolina. (Ferguson) Noted on Sunday with *English* announcements from 0900 to around 0920; stated program "originating in the studios of the Institute de Edison, Cuba's foremost educational institution in Havana"; network is RHC Cadena Azul (Cuban Blue Radio Network), the first telephone wire radio network in Cuba; also heard signing off 0100 in Spanish and *English*. (McClearen, Tenn.)

Cyprus—Lakatamia, 7.215, *"Forces Broadcasting Service,"* has ceased broadcasting on this channel and now is on m.w. *only*. (Bluman, Israel, via *Radio Australia*) The *"Voice of America"* is constructing a relay station for the Middle East near Nicosia. Sharq-el-Adna will soon move from Limassol, Cyprus, to Amman, Trans-Jordan. (Bluman, Israel, via ISWC)

Czechoslovakia—Not long ago in Prague's daily period 1900-2000 on 11.840 to North America, the announcer asked for listener reports and criticism; much improved signal noted. (Ormond, N. C.) In addition

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★ MIXER COIL For TV Front End ea. **89c** 10 for **$7.95**

★ Sound Powered MICROPHONE

Ideal for TV service work. With breast plate, strap and 20 feet of rubber covered shielded cable. Can be used as mike and receiver. Made by W. E. Wt. 7 lbs. Reduced to... **$3.49** ea.

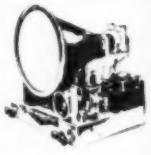
★ TV COMPONENTS

RCA Part No.		EACH
204L-1	Filter Choke	$ 0.12
203L-1	Peaking Coil	.26
203L-2	Peaking Coil	.26
203L-4	Peaking Coil	.26
201R-3	Horiz. line control	.43
201R-5	16" Horiz. line control	.48
201R-1	10" Horiz. Width control	.38
201R-4	16" Horiz. Width control	.43
211T-3	Horiz. output transformer	4.45
211T-5	16" Horiz. output transf.	5.60
204T-2	Vert. output transformer	2.95
208T-2	Vert. blocking transf.	1.55
202	Focus coil	6.34
4X2	Coil kit, complete	12.74

RCA Front End, Completely aligned 29.95
RCA Blank Chassis, punched 5.79
Universal mounting brackets (12" to 16" tube) 4.65

★ TECH-MASTER'S 630 TV KITS
The Super 16

- 3 TIMES PICTURE AREA OF 10-INCH TUBE
- 31 Tubes—Voltage Doubler
- Ultra-Simplified Wiring Instructions
- Easily Wired Over a Week-End



All components mounted. Complete with tubes (less CR tube). Shipped prepaid any part of U.S. **$177.50**

10 INCH DE LUXE KIT

All components mounted. Shipped prepaid any part of U.S. **$163.50**

30,000 volt RF Power Supply for Projection TV **$89.50**

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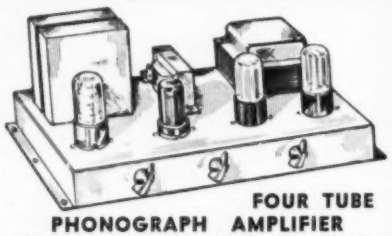
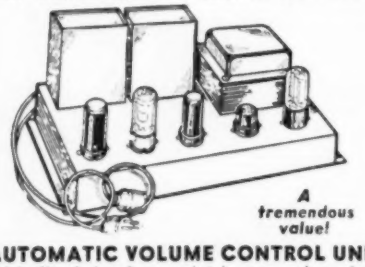


FOUR TUBE PHONOGRAPH AMPLIFIER

A dandy little amplifier with high-gain mike channel. Has 6V6GT output—hum free, **not** AC-DC has good-sized power transformer, 110V 60 cycle, AC. Includes output transformer to voice coil—tone control—separate volume controls for phone and mike—both can be used and mixed at the same time. Plenty of gain—fine tone..... **$12.95**



A tremendous value!

AUTOMATIC VOLUME CONTROL UNIT

Originally designed to maintain even volume level on Wurlitzer, Rock-ola, Seeburg and other coin-operated phonographs. Use also for AVC on phonographs, radios, amplifiers. Simple rewiring makes expander, compressor, peak-clipper, pre-amplifier. Five tubes—6SJ7, 6SK7, 6J5, 6H6, 5Y3. 40 ma. power transformer and adequate filter. Aluminum chassis, grey wrinkle finish with bottom cover plate. Shielded input and output cables with plugs also line cord with plug. Separate fuse. HI-impedance input and output for dynamic pick-up or mike. 110V, 60 cycle operation. Brand-new in original boxes **$5.95**

Prices subject to change without notice. All items subject to prior sale. 20% with all orders, balance C.O.D.

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A. J. GINKEL
Station WJLS
Beckley, W.Va.

"Stands out above all others"

VARIABLE RELUCTANCE CARTRIDGE

SEE PAGE 27

to the North American daily beam, Prague also broadcasts in *English* at 1245-1300, 11.840; 1445-1500, 9.550, and 1645-1700, 9.550, according to schedules just received by Balfe, Mass. It was stated: "We would appreciate letters and reception reports which should be addressed to *Czechoslovak Radio*, Prague XII, Stalinova 18, Czechoslovakia."

Denmark—The shift to 2100-2230 has resulted in considerable improvement in reception from OZF, 9.52, Copenhagen, in the North American transmission; *some English;* the transmission on OZH-2, 15.165, believed beamed to Latin America, appears to have been shifted to 1900-2000 (moved forward by one hour), and runs only on Monday, Wednesday, Friday.

Dominican Republic—HI2L, 9.525, Ciudad Trujillo, *"La Voz del Tropico,"* noted back on this channel mornings. (Stark, Texas) Listed with 500 watts. Heard in Australia to 0235 closedown in Spanish, according to Simpson, via *Radio Australia*. Bellington, N. Y., says is heard around 2300-2325 when is covered by *BBC* on same channel.

Eire—T. J. Monaghan, Engineer-in-Chief of *Radio Eireann*, Dublin, informs Osterman, N. Y., that "The Irish Short-Wave Station at present broadcasts news daily from 1:30 to 1:40 p.m. and 6:30 to 6:50 p.m. (that would be 0730-0740 and 1230-1250 EST) on 17.840. *A New 100 kw. s.w. station is expected to be in operation before the end of the year and is now in course of completion. The transmission hours will be between 1 a.m. and 4 a.m. local Summer Time (that would be 1900-2200 EST) and will be directed to North America."* While no frequency was mentioned for the new 100 kw. outlet, watch for it on one of these frequencies allocated to Eire—6.190, 9.595, 11.740, 15.120, 17.840. Incidentally, the 17.840 channel currently can be heard *occasionally* at 1230-1250 through terrific *QRM* from *Radio Brazzaville;* has beeen heard by Osterman, in New York, whose report was verified, and by Hankins in Pa., and by myself here in West Virginia.

Fernando Poo—Dobeson, England, airmails me that Fernando Poo's *"Radio Atlantica"* (to be 200 kw.) is still under construction; the studios and accessories were completed some time ago but opening is being held up awaiting high-powered tubes (probably from the U. S.).

French Equatorial Africa—Radio Brazzaville's 6.024 channel noted in *English* when tuned 1910. (Ferguson, N. C.)

Germany — Munich, 15.28, heard coming on the air 0845. (Peddle, Newfoundland) Is often heard point-to-point with *"Voice of America"* in New York around 0930-1000. (Balfe, Mass.)

Rias, listed 6.080, Berlin, has increased power to 100 kw., according to press dispatches from Germany.

Guatemala—TGWA, 9.76, 15.17, appears to be off the air.

TGDA, 7.460, Quezaltenango, heard

(*Continued on page* 153)

RADIO TUBES at Lowest Prices!

AM, FM, TV—Tremendous Selection of All Types—ORDER TODAY!

29c ea.

1T4 1U4 3A4 3Q4 3V4 6S8GT 01A 4A6G 6A3 6C4 6F8GT 6SD7GT 10 12A 14X7 39/44 47 50 71A 112A 182B

FREE! $20.00 List Value Cornell-Dubilier, Mallory, Aerovox, Sprague, Solar. Filter Condensers—ten fast moving filters FREE with each 100 tubes.

183 2S5 25Z6GT 482B 483 1A4 1A4P 1A6 1B5 1D5GT 1D7 1D8GT 1F4 1F5G 1G4GT 1G6GT 1H4G 1H6GT 1J6G

29c ea.

39c ea.

1C5 1C6 1L4 1R5 1S4 1S5 2A5 2A7 3Q5GT 3S4 5U4G 5W4GT 5X4G 5Y3GT 5Y4G 5Z3 6AC4 6AC5 6AC5GT 6AG5 6AK5 6AL5 6AL6 6AQ5 6AT6 6AU6 6A7 6A8G 6A8GT 6B6 6BA6 6BD6 6BE6 6BH6 6BJ6 6C5 6C8G 6D6 6F5GT 6F6GT 6G6 6H6 6H6GT 6J5 6J5GT 6J6 6J7G 6J7GT 6K6GT 6K7GT 6K8GT 6Q7 6Q7GT 6P5GT 6SA7GT 6SC7GT 6SG7 6SG7GT 6SH7 6SJ7 6SJ7GT 6SL7GT 6SK7GT 6SN7GT 6SQ7GT 6SR7 6U6G 6U6GT 6U7G 6U7GT 6V6GT 6W4 6X4 6X5GT 6Z4 12A8GT 12AT6 12AU6 12AU7 12AX7 12BA6 12BA7 12BE6 12F5GT 12H6 12J5GT 12J7GT 12K7GT 12K8GT 12S8GT 12SA7GT 12SF5 12SF7 12SG7 12SH7GT 12SJ7 12SJ7GT 12SK7GT 12SN7GT 12SQ7GT 12SR7GT 2050 2051 24A 25L6GT 25X6 25Z5 30 31 32 33 34 35 35B5 35C5 35W4 35Z3 35Z4GT 35Z5GT 35Z6GT 36 37 38 39 46 50A5 50B5

39c ea.

50Y6 51 56 57 58 75 76 77 78 80 84/6Z4 85 89

49c ea.

0Z4 1A5GT 1A7GT 1C7G 1H5GT 1LA4 1LE3 1N5GT 1P5GT 1Q5GT 1T5GT 1V 1C5GT 2A3 2B7 2C34 2E24 5V4 5Z4 6AC7 6AV6 6B4G 6B8 6C6 6D8 6D8G 6F5 6F8G 6K7G 6Q6 6AT6 6BA6 6BE6 6C4 6CB6 6E5 6J5 6K6GT 6L5G 6N5 6N6G 6N7 6P9 6Q7G 6R7 6SF5GT 6T7G 6T8 6U7 6W7G 6Y6G 6Z7G 7A4 7A7 7B6 7E5 7E6 7E7 7F7 7G7 7H7 7J7 7L7 7N7 7Q7 7S7 7T7 7W7 12A7 12AT7 12C8 12J5 12Q7GT 12Z3 14N7 19T8 20 32L7GT 35/51 35L6GT

49c ea.

36 40 41 42 43 50L6GT 117Z3 VR150 XXL/7A4

59c ea.

1B3 1AD5 1LA6 1LB4 1LC5 1LC6 1LH4 1LN5 2V3G 3LF4 6B7 6BG6G 6J8G 6L6G 6L6 6S7G 6SU7GT 6U5 45 70L7GT 81 117Z6GT 807

59c ea.

Above prices are for 50 tubes or more—may be assorted.

Less than 50 tubes, 5c per tube extra.

Individually boxed—Standard factory guarantee.

50L6, 35Z5, 12SK7, 12SQ7, 12SA7 All American Five. 5 tubes for **$1.95**

3S4, 1R5, 1S5, 1T4 Battery Tube Special. 4 tubes for **$1.29**

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Best quality Alnico 5 PM Speakers.

	10 or more Each	Price Each
5"-95c-$1.05		
2½", 3", 4"—95c - $1.05		
6"	$1.49	$1.59
8"	2.95	3.25
10"	4.25	4.50
12"	4.95	5.95

IF TRANSFORMERS

Standard Replacement Regular size ..... ea. **29c**
Midget ..... ea. 39c

4 PRONG VIBRATORS—VERY BEST BRANDS

Standard replacement—Sensational Value ..... **$1.29** ea.

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Standard replacement crystal cartridge. Each **$1.39**

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VERY BEST BRANDS

	10 or more Each	Price Each
½ meg. with switch—long shaft	29c	35c
2 meg. for battery sets—DPST switch, long shaft	29c	35c
½ meg., 1 meg., or 2 meg., long shaft, less switch	15c	19c

BY-PASS CONDENSERS

100 Condensers assorted in package **$5.95**

.001 mfd. 600 V. ..... ea. 6c
.002 mfd. 600 V. ..... ea. 6c
.005 mfd. 600 V. ..... ea. 6c
.01 ..... ea. 7c
.02 ..... ea. 7c
.05 ..... ea. 8c
.1 ..... ea. 9c

400 VOLT BY-PASS CONDENSERS

.2 mfd. ..... ea. 6c
.25 mfd. ..... ea. 10c
.5 mfd. ..... ea. 15c

BUFFER CONDENSERS

.005 mfd. 1600 WV
.008 mfd. 1600 WV
.01 mfd. 1600 WV
..... **15c** ea.

VARIABLE CONDENSERS

Two gang for superhet Standard ¼" shaft **69c**

CONDENSERS

OUTPUT TRANSFORMERS

For 50L6, etc. **39c** ea.

For 6V6, 6F6, 3Q5, etc. **45c** ea.

UNIVERSAL OUTPUT TRANSFORMER SPECIAL:

Up to 8 watts to any speaker ..... **98c** ea. (while they last)

PILOT LIGHTS—100 BULBS $4.90

1 box of 10 bulbs **54c**

No. 40 6-8 V .15 Amps.	No. 46 6-8 V .25 Amps.
No. 41 2.5 V .50 Amps.	No. 47 6-8 V .15 Amps.
No. 44 6-8 V .25 Amps.	No. 51 6-8 V .20 Amps.

6-Ft. LINE CORDS

Good Rubber with plug. 10 for **$1.25**

Underwriters' Approved. 10 for **$1.69**

SELENIUM RECTIFIERS

Standard 100 mil. Each **79c**

PUSH-BACK WIRE 100 ft. rolls ..... **39c** each

FILTER CONDENSERS

Very best brands. Fresh stock

450 Working Volts

8—450 V ..... ea. 21c
10—450 V ..... ea. 24c
10—450 V with 20-20—25 V ..... ea. 29c
15—450 V ..... ea. 29c
20—450 V ..... ea. 39c
30—450 V ..... ea. 49c
30—450 V with 20-20—25V ..... ea. 29c
8-8—450 V ..... ea. 39c
10-10—450 V ..... ea. 43c
20-20—450 V ..... ea. 49c

150 Working Volts

15-15—150 V ..... ea. 29c
20-20—150 V ..... ea. 29c
20-20-20—150 V ..... ea. 39c
30-30—150 V ..... ea. 39c
40-20—150 V ..... ea. 39c
40-30—150 V-30-20-25 V ..... ea. 39c
40-40—150 V ..... ea. 39c
40-40—150 V-25-25V ..... ea. 39c
50-30—150 V ..... ea. 39c
50-50—150 V ..... ea. 39c
60-60—150 V ..... ea. 39c
15—150 V ..... ea. 21c
16—150 V ..... ea. 23c
20—150 V ..... ea. 25c
30—150 V ..... ea. 29c
40—150 V ..... ea. 29c

25 Working Volts

10—25 V ..... ea. 16c
20—25 V ..... ea. 16c
25—25 V ..... ea. 16c
100—25 V ..... ea. 16c
20-16-16—350 V Sprague type ..... ea. 39c
25-25—150V-200-10V ea. 39c

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Specialists know that it is often the one little "finnigan pin" which holds up the final completion of a well engineered and constructed sound system.

Atlas produces not only a complete line of speakers and accessories but also fittings, adaptors, parts and gadgets. Atlas stocks these small items for your convenience. This is just part of the "all around" service to users of ATLAS SOUND EQUIPMENT.

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Brooklyn 18, New York

Wide Range Amplifier

(*Continued from page* 53)

approximately unity at middle frequencies, but approaches 100 at the extremes of frequencies.

High-priced equalizers, as used by broadcast stations and recording studios, use tuned circuits to get their boost and attenuation. Unfortunately, high-Q audio reactors having adequate shielding and low incremental permeability (i.e. in which the inductance does not change with power level) are very expensive, hence, the RC combinations plus tube. A 7C7 pentode was chosen as the amplifier, as it draws but 150 ma. of filament current. The power for the unit was "borrowed" from the set itself, by means of an adaptor placed under one of the power amplifiers. A 6SJ7 or 57 would do the job equally as well.

The unit may be constructed on a chassis of any convenient size. This one was built on a U-shaped piece of aluminum which fits conveniently into a corner of the radio cabinet, permitting the two controls to extend through the panel for easy manipulation. Most of the resistors and condensers comprising the equalizing circuits were assembled on a terminal board having 15 sets of soldering lugs. The bass switch is of the type which progressively short-circuits contacts as the switch is rotated. The switch shown had one more contact than was necessary; this was filled with solder. The only precaution necessary is to keep the filament wiring short and spaced away from the other wires.

In this construction, the pickup was provided with a pin plug which fits a jack on the radio chassis. A similar plug and jack were obtained; the jack was mounted on the equalizer chassis to take the pickup lead, and the shielded lead from the equalizer was fitted with the plug, which went into the jack on the set. Almost all radio-phono combinations are fitted with this identical plug and jack. The only thing that the wiring diagram does not specify is the value of R_{19} which, with the volume control of the set proper, must total 2 megohms. If the volume control is 1 megohm, R_{19} is 1 megohm; if the volume control is .5 megohm, R_{19} is 1.5 megohm, and so on.

When the unit was placed in operation, results far exceeded expectations. The bass boost was smooth and natural, and did not in the least affect the middle and high frequencies. The treble boosting made records which had previously sounded dead come to life. On worn records, rotating the tone control full counterclockwise almost completely eliminated scratch, while still preserving a good deal of the brilliancy.

All in all, the unit was a decided success, and anyone desiring an improvement in phonograph reproduction would do well to include one in his setup. —30—

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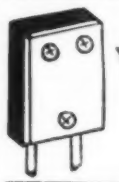
RADIO TUBES — 39c each
100 for $35.00

GT type. Cartoned and guaranteed.

O1A	6A8	6K7	6X5	12SR7	41
1B5/25S	6AQ5	6P5	6U6	12BE6	42
1G4	6AQ6	6S8	12A8	12BF6	38
1H6	6AT6	6SA7	12AT6	12F5	46
1J6	6AU6	6SD7	12AT7	12H6	47
1L4	6BA6	6SF5	12AU6	12J5	50B5
1Q5	6BE6	6SG7	12AU7	12J7	70L7
1R4	6BH6	6SH7	12BA6	12K7	80
1R5	6BG6	6SJ7	12SF7	12K8	117Z3
1S5	6AL5	6SK7	12SH7	12Q7	12A
1T4	6C4	6SL7	12SJ7	12S8	6J7
1U4	6C5	6SN7	12SN7	25Y5	6K8
3A4	6F5	6SQ7	10	32L7	
3Q4	6F6	6SR7	20	37	
3S4	6H6	6SU7	25L6	35W5	
3V4	6J5	6V6	25Z5	39/44	
5Y3	6K6	6X4	25Z6	40	

49c each, 100 for $45.00

1A5	6AC7	6Y7	27	56	78
2A5	6B8	12AH7	35/51	57	81
2A7	6C6	12SA7	35L6	58	84/6Z4
5U4	6D6	12SK7	32	71A	117P7
6A3	6F8	12SQ7	36	75	
6A6	6Y6	26	50	77	



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Your frequency plus or minus 10KC

80 Meter, 3500-4000KC
40 Meter, 7000-7300KC for multiplying into
20 Meter, 7300-7425KC
10 Meter, 7300-7425KC
2½ Meter, 8000-8222KC

TOP COWL ANTENNA 98c

4 section. 15" closed, extends to 48". Less lead-in 98c, 10 for **$7.95**

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THE ORIGINAL CONICAL TV ANTENNA

Single Stack. Model 2X complete. Only **$7.95**

Double Stack. Model 4X complete. Only..... **$14.95**

RCA TYPE 630 CHASSIS

Completely wired and tested with all tubes except Picture tube. Standard RMA guarantee.

Operates 10"-12"-16" Picture Tube. ONLY **$174.50**

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BAUSCH & LOMB F1.9 PROJECTION TV LENS

F1.9 EF.5 in. (127.0 mm). For use with Type 5TP4 Tube. Lens will project suitable pictures up to 6x9 feet. Reg. $125.00.

SALE PRICE ONLY **$59.95**

5TP4 Projection Kinescope.....Net Price **$67.50**
RCA KRK-2 Tuner complete with tubes..... **34.50**
G.E. 13KV Conversion Kit. Includes all parts necessary to convert H.V. supply on any 10" T.V. set to operate up to 20" Picture Tube. Priced at Only.....**$10.98**

T.V. Parts for RCA 630 Chassis Sold Separately.
Write for complete list of parts and prices.

FAMOUS NAME C.R. TUBES
ALL RMA GUARANTEED

10BP4—10"	$26.95
12TP4—12½"	44.50
15AP4—15"	59.50
16AP4—16"	64.50

TERMS: Cash with Order or 20% Deposit. Balance C.O.D.

Prices Are Net F.O.B. Asbury Park, N. J.

EDWARDS
TELEVISION SUPPLY
Box 525 ASBURY PARK, N. J.

Tubeless Tone Generator

(*Continued from page* 39)

from heat effects, tubeless operation resulting in long life and almost zero maintenance, and the fact that the output signal has the same frequency stability as that of the input signal.

The diode-type tone generator has many practical applications, such as use as a bridge signal source, modulator, a.f. amplifier, signal injector, etc., which suggest themselves immediately to the experimenter and amateur. One such application is the code practice oscillator shown in the photographs and in Fig. 1B. This unit is operated from the 117 volt a.c. power line at exceedingly low power drain and delivers an output signal at 240 cycles. This is a pleasant, easily-read tone frequency, and we did not see the advisability of adding another doubler stage to obtain the higher-frequency output of 480 cycles which it would have afforded.

The "oscillator" uses four 1N34 crystals. It might, instead, employ two type 1N35 dual crystal units, if desired. Operation will be identical with either type of crystal. However, do not attempt to employ silicon crystals (such as the 1N21 series), since the latter are not designed to handle the relatively high currents flowing in the multiplier stages.

Transformer T_2 may be any convenient microphone transformer having a 200 ohm primary and a center-tapped secondary designed for push-pull grids. The transformer shown in the photograph happens to be an "ouncer" type salvaged from an inexpensive government surplus inter-comm. amplifier.

The entire code practice unit is built into a 5"x3"x2" box chassis. The unit has sufficient wallop to supply a number of high-resistance headphones and may be keyed by a machine as well as by hand key.

—30—

THE MOUNTING TV SET PRODUCTION

ACCORDING to figures received from Radio Manufacturers Association member companies, over one million television receivers were produced during the first half of 1949. This estimated total for just the first half of the year exceeded the total produced during the whole of last year.

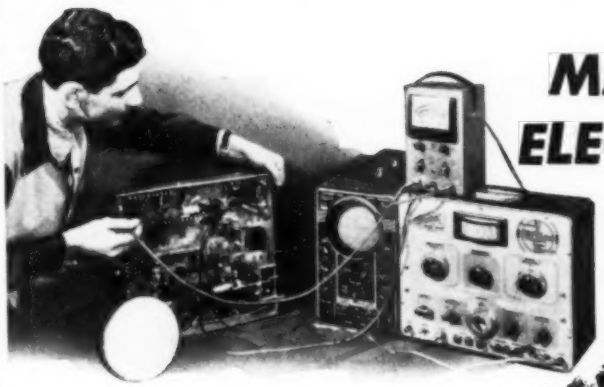
Following is the breakdown in television set production by RMA members for the first half of 1949: January, 121,238; February, 118,938; March (five weeks), 182,361; April, 166,536; May, 163,262; and June (five weeks), 160,736; a total of 913,071. Of this figure, 591,482 were table models.

Assuming that an additional 15 percent was produced by kit manufacturers and non RMA members will bring the number of sets manufactured in the first six months of 1949 to a total of 1,050,032.

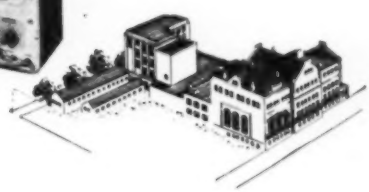
—30—

Become an

ELECTRICAL ENGINEER



MAJOR IN ELECTRONICS



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This 46-year-old, non-profit Technical Institute offers a world-famous course in Electrical Engineering *with a major in Electronics.* You follow an industry-guided program which is constantly attuned to current developments. It presents a solid background in the basic sciences . . . Chemistry, Physics, Mathematics, Economics and Electrical Engineering subjects . . . plus 19 technical specialty courses in Engineering Electronics, including four courses in Electronic Design.

Practical, military or academic training will be evaluated for advanced credit.

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At the end of the first year of study of the Electrical Engineering course, the student is qualified as an Electronic Technician.

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To young men interested specifically in radio and television: Prepare here for a career in television—the field which business leaders predict will be among America's top ten industries by 1951. In 18 months you become a Radio-Television Technician, ready for positions in receiver and transmitter testing, servicing, sales, supervision and production. Because of this school's *concentric curriculum,* the Bachelor of Science degree in Electrical Engineering (Electronics major) may be earned in 24 additional months.

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3 GREAT NEW TITONES

meet changing pickup needs!

NOW a full line of Titone's amazing ceramic pick ups—made by famous Sonotone! All with these great basic features: Full frequency (response from 50 to 10,000 cycles.) Bell-like supertone makes new or old players thrilling. Climate-proof, moisture-proof, fungus-proof! Lightest pressure saves needle wear, revives worn records. NO needle talk! NO crystals, magnets, filaments to fail. NO pre-amplifiers. Performs perfectly for years!

3 NEWEST! TITONE MICROGROOVE PICKUP

For all 45 and 33⅓ rpm players. Highest compliance and 5 to 6 grams needle pressure give minimum wear on record and needle! Aluminum case—1-mil permanent sapphire needle.

Order #W 7530 ..... $7.95 list

2 NEWER! TITONE 3-MIL PICKUP

New superlight aluminum pickup complements famous original Titone pickup below. 15 grams needle pressure gives unparalleled reproduction, lowest wear!

Order #W 7540 ..... $7.95 list

1 NEW! ORIGINAL CERAMIC TITONE

Within a few scant months in widest use from coast to coast! Plays at 20 grams needle pressure. Used instead of the newer aluminum Titone above for changers requiring over 15 grams pressure to "flip" records.

Order #7500 ..... $7.50 list

Call your Jobber or write to SONOTONE, Box 5, Elmsford, N. Y.

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

RCA PICT-O-GUIDE

A loose-leaf handbook on television trouble-shooting issued by *RCA Tube Department*, Camden, New Jersey, shows common operating troubles encountered in receivers and should be useful as a shop tool or study volume.

To permit localization of TV receiver faults more quickly, the book is designed on the "picture analysis" method whereby the picture displayed on the screen of the receiver is compared with a similar picture in the "Pict-o-Guide." Captions under each photo describe the symptoms and explain the causes of the difficulty. Each chapter of the guide has a basic section of the receiver, providing a complete schematic of the basic circuit for the particular section.

Users of *RCA* electron tubes may obtain the guide through *RCA*, *RCA Victor* or *Cunningham* distributors.

SOLDERING GUN CATALOGUE

A recently issued specification bulletin of the *Weller Manufacturing Company* describes the new soldering gun line, including Model WD-250, designed for heavy-duty with a 250 watt handling capacity. Features of the *Weller* guns are fast, five-second heating and prefocused spotlights.

Specifications, characteristics, tip types, and prices for each of the four models covered are included in the bulletin. Address the company at 808 Packer Street, Easton, Pa., for a free copy.

LEKTROMESH FOLDER

A plated screen, designed for use in aircraft, radio-communications, automotive, and chemical applications, is described in a new bulletin put out by the *C. O. Jelliff Mfg. Corp.*, Southport, Conn.

The screen is formed by the electrodeposition of pure copper, pure nickel, or a combination of the two. It is being used as a filtering medium, for electronic shielding, and even as decorative material.

Illustrations and specifications in the new booklet give complete information. The material is free of charge.

SIX ELECTRO-VOICE BULLETINS

Electro-Voice, Inc., Buchanan, Michigan, has issued a series of six bulletins on its line of pickups, microphones, and phono cartridges.

Illustrated bulletin No. 150 shows how the E-V touch-to-talk stand works with light finger-tip action, and fits any microphone with standard ⅝ inch 27 thread.

A four-page booklet, No. 104, gives concise information and list prices on the company's line of microphones and stands for all types of applications. A special bulletin, No. 154, highlights the features of the Mercury Model 911 crystal and Model 611 dynamic microphones.

Three folders have been made available on the E-V phono cartridges and pickups. These bulletins, Nos. 153, 152, and 151, as well as the others, may be obtained free of charge by writing to the company at the above address.

DUBIN CATALOGUE

Bulletin No. 78, published by the *Dubin Electronics Co., Inc.*, 103-02 Northern Boulevard, Corona, New York, provides illustrated material and specifications on the *Lambda* regulated power supplies, and *Western Electric* and *General Electric* generators, plus many government surplus items.

The company will send bulletins to all who desire them on a regular basis; simply cable "Dublectron, New York." Write Dept. E-6 for the latest catalogue.

SWITCHCRAFT CATALOGUE

Containing valuable engineering data and complete listings on many new products used in radio and electronics, a catalogue has been issued by *Switchcraft, Inc.*, 1328-30 N. Halsted St., Chicago 22, Ill.

Specifications and prices on jacks, plugs, switches for low-power applications, schematic circuits, and detailed line drawings are given.

All of these products are available at most radio jobbers, and the booklet may be obtained free of charge from the company.

NEW CONNECTOR BULLETIN

A revised fourth edition of the *Cannon* connector bulletin, No. LS4-1248, has been put out by *Cannon Electric Development Company*, Catalogue Department, 3209 Humboldt St., Los Angeles 31, California.

The eight-page bulletin in two colors contains application photographs, explanatory material, dimensional sketches, and complete assembly photographs on all types of laboratory testing equipment and experimental operations. Twelve different standard fittings, ranging from one to four contacts, rated at 75 amperes, comprise the series.

G-E POCKET OFFICE

Designed to be taken along on service calls, a new sales aid has been announced for radio and television serv-

SELENIUM RECTIFIERS
— and —
ELECTRONIC COMPONENTS

THREE PHASE FULL WAVE BRIDGE RECTIFIERS

Input 0-126 VAC Type #	Current	Output 0-130* VDC Price
3B7-4	4 AMP.	$32.95
3B7-6	6 AMP.	48.90
3B7-15	15 AMP.	70.00

Input 0-234VAC Type #	Current	Output 0-250*VDC Price
3B13-4	4 AMP.	$56.00
3B13-6	6 AMP.	81.50
3B13-15	15 AMP.	120.00

CENTER TAPPED RECTIFIERS

Single Phase

Input 10-0-10VAC Type #	Current	Output 0-8*VDC Price
C1-10	10 AMP.	$6.95
C1-20	20 AMP.	10.95
C1-30	30 AMP.	14.95
C1-40	40 AMP.	17.95
C1-50	50 AMP.	20.95
C1-80	80 AMP.	26.95
C1-120	120 AMP.	34.95

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- UNIVERSITIES
- GOVERNMENT AGENCIES

We will be pleased to quote on your requirements.

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Input 0-18VAC Type #	Current	Output 0-12*VDC Price
B1-250	250 MA.	$0.98
B1-500	500 MA.	1.95
B1-1	1 AMP.	2.49
B1-1X5	1.5 AMP.	2.95
B1-3X5	3.5 AMP.	4.50
B1-5	5 AMP.	5.95
B1-10	10 AMP.	9.95
B1-15	15 AMP.	13.95
B1-20	20 AMP.	15.95
B1-30	30 AMP.	24.95
B1-40	40 AMP.	27.95
B1-50	50 AMP.	32.95
B1-60	60 AMP.	36.95
B1-80	80 AMP.	44.95

Input 0-36VAC Type #	Current	Output 0-26*VDC Price
B2-150	150 MA.	$0.98
B2-250	250 MA.	1.25
B2-300	300 MA.	1.50
B2-450	450 MA.	1.95
B2-1	1 AMP.	3.95
B2-2	2 AMP.	4.95
B2-3X5	3.5 AMP.	6.95
B2-5	5 AMP.	9.95
B2-10	10 AMP.	15.95
B2-15	15 AMP.	24.95
B2-20	20 AMP.	27.95
B2-30	30 AMP.	36.95
B2-40	40 AMP.	44.95

Input 0-54VAC Type #	Current	Output 0-38*VDC Price
B3-150	150 MA.	$1.25
B3-250	250 MA.	1.95
B3-600	600 MA.	3.25
B3-5	5 AMP.	13.95
B3-10	10 AMP.	24.95

Input 0-72VAC Type #	Current	Output 0-50*VDC Price
B4-600	600 MA.	$3.95
B4-3	3 AMP.	14.95
B4-5	5 AMP.	17.95
B4-10	10 AMP.	27.95

Input 0-115VAC Type #	Current	Output 0-90*VDC Price
B6-150	150 MA.	$1.95
B6-250	250 MA.	2.95
B6-600	600 MA.	5.95
B6-750	750 MA.	6.95
B6-1X5	1.5 AMP.	10.95
B6-3X5	3.5 AMP.	18.95
B6-5	5 AMP.	24.95
B6-10	10 AMP.	36.95
B6-15	15 AMP.	54.95

Input 0-234VAC Type #	Current	Output 0-190*VDC Price
B13-600	600 MA.	$12.95
B13-1X5	1.5 AMP.	19.95
B13-3	3 AMP.	35.95
B13-5	5 AMP.	48.95
B13-10	10 AMP.	69.95

* Select Proper Capacitor to Obtain Higher DCV Than Indicated.

RECTIFIER CAPACITORS

CF-14	3000 MFD	12VDC	$1.69
CF-15	6000 MFD	12VDC	2.95
CF-1	1000 MFD	15VDC	.98
CF-2	2000 MFD	15VDC	1.69
CF-20	2500 MFD	15VDC	1.95
CF-3	1000 MFD	25VDC	1.25
CF-4	2X3500 MFD	25VDC	3.45
CF-5	1500 MFD	30VDC	2.49
CF-6	4000 MFD	30VDC	3.25
CF-7	3000 MFD	35VDC	3.25
CF-8	100 MFD	50VDC	.98
CF-19	500 MFD	50VDC	1.95
CF-16	2000 MFD	50VDC	3.25
CF-21	1200 MFD	90VDC	3.25
CF-9	200 MFD	150VDC	1.69
CF-10	500 MFD	200VDC	3.25
CF-12	125 MFD	350VDC	2.49

RECTIFIER TRANSFORMERS

All Primaries 115VAC 50/60 Cycles

Type #	Volts	Amps.	Price
XF15-12	15	12	$3.95
TXF36-2	36	2	3.95
TXF36-5	36	5	4.95
TXF36-10	36	10	7.95
TXF36-15	36	15	11.95
TXF36-20	36	20	17.95
XFC18-14	18VCT	14	5.95

All TXF Types are Tapped to Deliver 32, 34, 36 Volts. XFC Type is Tapped to Deliver 16, 17, 18 Volts Center Tapped.

RECTIFIER CHOKES

Type #		Amps.	Price
HY5	.02 Hy	5	$3.25
HY8X5	.02 Hy	8.5	7.95
HY10	.02 Hy	10	9.95
HY12	.02 Hy	12	12.95
HY15	.015 Hy	15	13.95

RECTIFIER MOUNTING BRACKETS

For Types B1 through B6, and Type C1 ..... $0.35 per set
For Types B13 ..... .70 per set
For Types 3B ..... 1.05 per set

RECTIFIER KIT

6 and 12 VDC at 10 Amps.

This unit will deliver unfiltered direct current for operation of motors, dynamotors, solenoids, electroplating, battery charging and similar equipment.

The following components are supplied:

1 ea. Full Wave Bridge Rectifier
1 pr. Rectifier Mounting Brackets
1 ea. Transformer 115 VAC 50/60 CPS.
3 ea. Silver-Plated Binding Posts
1 ea. 4-Position Tap-Switch
1 ea. Fuse and Fuse Holder
1 ea. Line Cord and Plug
1 ea. Pilot Light Assembly & Bulb

The primary of the transformer is multi-tapped permitting adjustment of the DC output voltages.

Complete with schematic diagram and instructions; Shpg. wt., 12 lbs. **$15.95**

FILTER KITS FOR ABOVE

1 section choke input, 10% ripple... **$ 9.64**
2 section choke input, 2% ripple... **19.28**

SYNCHRO MOTORS

Type 1F Special—KS-5949, L1 Western Electric. 115/90 VAC—400 Cycles. Brand new—Boxed. Price Each.. **$8.00**

WRITE FOR SELENIUM RECTIFIER CATALOG NO. 719 ON COMPANY LETTERHEAD.

VACUUM CAPACITORS

Standard Brands

12 Mmfd.	20 Kv	$4.95
50 Mmfd.	20 Kv	4.95
50 Mmfd.	32 Kv	5.95

SILVER CERAMIC TRIMMERS

820-Z	5-20 Mmfd Zero Temp.	24c
822-N	5-20 Mmfd Neg. 300	24c
822-AZ	4.5-25 Mmfd Zero Temp.	24c
823-AN	20-125 Mmfd Neg. 650	33c

OIL CONDENSERS

2 Mfd. 200VDC Bathtub	$0.20
.5 Mfd. 400VDC. Telephone Type	.20
2 Mfd 400VDC Bathtub	.30
2X.1 Mfd 600VDC Bathtub	.39
6 Mfd. 600VDC w/mtg. clamp	.79
10 Mfd 440VAC/1500VDC w/brkts	1.55
8 Mfd 660VAC/2000VDC w/brkts	3.50
.15-.15 Mfd 8000VDC Voltage Doubler Type 26F381 w/brkts	3.95

ATTENTION!!!

Bulletin No. 713, listing various government and commercial surplus items, is now available upon request.

VOLTAGE REGULATORS

These solenoid operated carbon pile regulators will stabilize the output of 12-18 VDC power supplies, simply by connecting the coil leads across the output of the rectifier, and the carbon element leads in series with the load. Price each **$2.49**

D-C POWER SUPPLY FTR 3377-AS

Rating 115 VAC to 115 VDC, .77 Amperes. Operates fans, motors, magnetic chucks, business machines, relays, etc. Descriptive literature available.
Complete, ready to operate **$16.50**

D-C PANEL METERS

Attractive, rugged, and reasonably priced. Moving vane solenoid type with accuracy within 5%.

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0-12 Amperes D-C — Any range $2.49 each
0-15 Volts D-C

Minimum order $3.00. No C.O.D.'s under $25.00. 25% deposit on C.O.D. Add 10% for Prepaid Parcel Post and Handling. Terms: Net 10 days in the presence of approved credit.

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Contains everything you need. Instruction book, metal chassis, tubes, condensers, resistors and all other necessary radio parts. The Instruction Book written by expert radio instructors and engineers teaches you to build radios in a professional manner. The circuits are designed to provide excellent performance.
Each of the 15 radios you will build operates on 110-120 volts AC or DC. The PROGRESSIVE Radio Kit is excellent for learning the principles of Receiver, Transmitter and Amplifier design. It is used in many Radio Schools and colleges in U.S.A. and abroad. It is used by the Veterans Administration for veteran training.
FREE: ELECTRICAL AND RADIO TESTER, plus FREE Membership in the Progressive Radio & Television Club. You will be entitled to FREE expert advice and consultation service with licensed radio technicians. **ORDER YOUR KIT NOW!**

7"-10" TELEVISION KITS
Factory-built and aligned 13 channel Tuner—18 Tube Kit—7" Kit **$59.50**
Complete set of tubes, including Cathode Ray Tubes... **$41.58**
Factory-built and aligned 13 channel Tuner, 10" Kit, less tubes..... **$82.99**
Complete set of tubes, including Cathode Ray Tube **$55.80**
Cabinet for 7" or 10"..... **$24.50**
FREE: Television Servicing Notes.

5" OSCILLOSCOPE KIT
AM-FM TELEVISION—An absolute "must" for today's radioman. Input Impedance: 1 Meg. and 50 Mmfd. Tubes—2-6SJ7, 2-5Y3, 1-884, 1-5BPI. FREE: Book on Cathode Ray Oscilloscope **$39.95**

VACUUM TUBE VOLTMETER KIT
A professional piece of test equipment you need for FM and TV. Attractive steel case. FREE: Book on Advanced Servicing Techniques **$23.95**

SIGNAL TRACER KIT
An invaluable aid in trouble-shooting. FREE: Book on Radio Test Instruments..... **$21.95**

SWEEP GENERATOR KIT
A necessity for television work. 5-Tube circuit. 2MC to 226MC. Sweep width 0 to 10MC. Variable phasing control . . . 110v 60C operation.
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AM & FM alignment and trouble-shooting marker for sweep generator. 150kc to 34 MC on fundamentals. Over 100 MC on strong harmonics. 400 cycle audio. 110V 60C operation.
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TOOL KIT
Consists of Diagonal cutters, combination long-nose pliers and cutters, amber-handle screwdriver, 75 watt soldering iron, and supply of solder **$5.75**
FREE: 35 Watt, Midget soldering iron and supply of hook-up wire.

OTHER KITS
7-Tube FM Receiver, Battery portable receiver, 3-way Portable Receiver, 5-Tube Bro dcast Band Superhet Receiver, 6-tube 2-band superhet receiver, multi-tester, amplifier, signal tracer probe.
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Deduct 2% if full payment accompanies order.
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Brooklyn 11, New York

ice technicians and dealers by the *General Electric Company* Tube Division, Schenectady, N. Y.

The sales aid is patterned along the lines of a billfold and has a number of stitched pockets for holding business cards, chassis stickers, job cards, tube test stickers, outcards and job tickets. Each carrying case also contains a pocket-size price list on receiving tubes and a note pad and card bearing Ohm's law and resistor and condenser codes.

The Pocket Office is available free of charge through *G-E* and *Ken Rad* tube distributors.

ELECTRICAL PRODUCTS CATALOGUE

Designed to take the place of many individual pieces of literature applying to its various products, the new 35-page catalogue, "Electrical Products for Farm and Home," gives illustrations and complete descriptions of all *Westinghouse* products that can be used on farms.

Functions of the publication are to provide farm dealers with a convenient selling tool. Among the products presented are radio and television sets, motor controls, motors, wiring devices, home appliances, etc.

The booklet, B-4042, is available upon request to Westinghouse farm dealers, or by writing to *Westinghouse Electric Corp.*, 306 Fourth Ave., Box 1017, Pittsburgh 30, Pa.

RADIATION COUNTER TUBES

Amperex Electronic Corporation, 25 Washington St., Brooklyn 1, N. Y., has issued an 8-page booklet on self-quenching radiation counter tubes for use in research and in industry.

Illustrations and tables of specifications are shown on the alpha and beta counters, alpha, beta, and gamma, beta-gamma-x-ray, and gamma counters. The company also makes tubes for experimental and special applications.

DEALER INFORMATION

A "line" folder put out by the *Noblitt-Sparks Industries, Inc.*, Columbus, Indiana, shows the wide range of decorators' colors available in the *Arvin* radio sets.

Emphasis is being placed on color in the *Arvin* line because of the tendency of homemakers to blend their furnishings into the decorative schemes of their various rooms.

TRACERLAB CATALOGUE A

A 39-page catalogue on radioactivity detectors has been printed by *Tracerlab, Inc.*, 55 Oliver Street, Boston 10, Mass., giving complete information and specifications on its counters and detectors, absorbers, precipitation apparatus, lead shields, and assorted laboratory equipment.

Each piece of equipment is fully illustrated and described, and complete specification tables are also provided. Portions of the book are devoted to radiochemical services and information on protective devices. Everything

TREMENDOUS SCOOP!

Brand New
COIN-OPERATED RADIOS — (While They Last)

Finest coin-operated radio ever manufactured

Originally sold for $70.00. We purchased complete stock and offer these all new (original carton) radios for only **$36.95** Each
In lots of 5 or more.
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Individual price $39.95 ea. F.O.B. Chicago

- Plays one or two hours for 25c—your choice
- 6 tube superheterodyne
- Operates on 105-125 volts—AC, 50-60 cycles
- Internal volume control
- 9" x 7" x 15"
- All steel cabinet, gray wrinkle finish
- Double-locked cabinet & coin mechanism
- Has slug rejector for your protection
- Needs no servicing
- Tubes guaranteed for 90 days
- Mechanism guaranteed for one year
- Satisfaction guaranteed.

Mail orders filled immediately. Send 25% deposit with order.

ORDER TODAY

Here is your opportunity to get into a really profitable business.

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Listen to your most cherished orchestral selection on the

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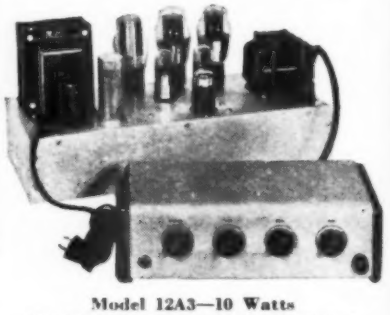

Model 12A3—10 Watts
(Model 10C3—30 watts also available)

For REALISM in critical music reproduction. Hear this finest of amplifiers at your Brook Dealer's now!

Use of triodes in all stages—together with Brook-designed transformers, produces cleanest amplification. Distortion minimized to negligibility.

Write TODAY For FREE Technical Bulletin and Detailed Distortion Analysis

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Dept. RJ-9 34 DeHart Place
Elizabeth 2, New Jersey

relating to radiochemistry and x-ray in the way of research is covered in this handbook, entitled Catalogue A.

CASTING DATA SHEET

Cooper Alloy Foundry Co., Hillside, N. J., is making available on request its four-page bulletin recently compiled on corrosion resistance of stainless, monel, and nickel castings.

Chief Chemist and Metallurgist N. S. Mott of the *Cooper* firm prepared the comprehensive sheet to aid materials engineers in selecting the best alloy when corrosive agents and conditions are known.

TRANSMISSION BELTING DATA

United States Rubber Company, Rockefeller Center, New York 2, New York, has recently issued a new catalogue comprising 28 pages on its line of transmission belting, from studies made by the mechanical goods division.

Details of design, engineering, and performance are given, and the booklet also includes tables on belt speeds, arc of contact, friction, horsepower correction, and information on durability and service.

The company has added hints on the proper selection of transmission belting and procedures for analyzing belt drives. Copies are free of charge.

THERMOSTAT BULLETIN

A bulletin containing a schematic drawing of operating principles on the company's Type C standard and hermetically sealed thermostats is offered by the *Stevens Manufacturing Company, Inc.*, Mansfield, Ohio.

The bulletin, F-2002, describes uses of the *Stevens* bi-metal strip thermostats, showing how a high degree of temperature stability is provided to fill the requirements of communications equipment, electronic devices, and other types of electrical apparatus.

SUTTON TOOL CATALOGUE

A new 25-page catalogue, liberally illustrated with many special tools, has been issued by *Sutton Tool Company* of Sturgis, Michigan, and is available free of charge.

In addition to the *Sutton* standard line of screw machine collets, special items such as expanding mandrels, spring chucks, milling machine adapters, and chuck jaws are illustrated.

Descriptions and advantages of diamond-serrated, quick-change, full-floating, and standard master collets and various types of master feeders are given, with illustrations and cross-section views. Second half of the catalogue is devoted to specifications and list prices of collets and fingers for automatic and hand machines, and turret lathes made by several different companies.

COOPER BULLETIN

"Names of Valve Parts" is the title of a new bulletin just published by *The Cooper Alloy Foundry Co.*, Hillside, N. J., copies of which are available on request.

2 NEW MHB BOOKS—Just Published!

NOW YOU'LL REALLY KNOW How To Use an Oscilloscope

Don't let the oscilloscope "stump" you! Learn to use it properly—and watch your efficiency and earnings soar! No other instrument is so intensely valuable in AM-FM and TV servicing. Here, at last, is a complete, easy-to-understand book by an expert who gives you the oscilloscope facts and how-to-use-it data you've been wanting.

MODERN OSCILLOSCOPES AND THEIR USES

by JACOB H. RUITER, Jr.
of Allen B. Du Mont Laboratories, Inc.
350 pages, 400 illustrations
Price $6.00

WHAT IT IS—HOW IT WORKS

1. Introduction to Oscilloscopes
2. History of the Oscillograph
3. The Development of the Cathode Ray Tube
4. Principles of Cathode Ray Tube Operation
5. Details of the Modern Cathode Ray Tube
6. The General Purpose Oscilloscope
7. Power—Supply Circuits
8. Amplifiers, attenuators, and Positioning Circuits
9. Time-Base Circuits

HOW TO USE IT ON THE JOB

10. Operation of the Oscilloscope
11. Interpretation of Basic Patterns
12. Auxiliary Equipment
13. Typical Applications in the Electronics Industry
14. Servicing A-M Radio Receivers
15. Servicing F-M Radio Receivers
16. Servicing Television Receivers
17. Use of the Radio Transmitter
18. Using the Oscilloscope in Teaching
19. Additional Industrial Uses of the Oscilloscope
20. Photographing Cathode-Ray Patterns (a) Glossary

This big book gets right down to earth in explaining the oscilloscope (cathode ray oscillograph) and showing exactly how to use it on specific AM-FM-TV service jobs. No guesswork. No involved mathematics. First the author explains all about the instrument—how it is made—when and where to use it—how it works. Then he tells exactly how to employ it on specific jobs—from locating many types of receiver troubles to aligning and adjusting the most complicated circuits.

Each operation is carefully explained including the making of connections, adjustment of circuit components, setting the oscilloscope controls, and analyzing oscilloscope patterns. About 400 illustrations, including literally dozens of pattern photos, make things doubly clear.

Besides its radio and TV uses, you learn about many oscilloscope applications in industry and medicine. Send coupon today for your copy of MODERN OSCILLOSCOPES AND THEIR USES. If not more than satisfied, return it after 10 days and we'll gladly refund the purchase price.

FACSIMILE

WHAT IT IS—HOW IT WORKS— MODERN FACSIMILE SYSTEMS *and how to service them*

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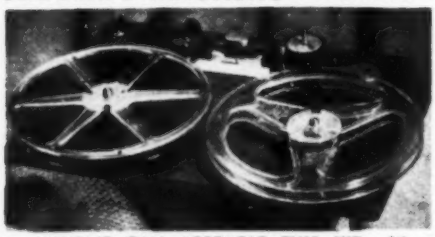

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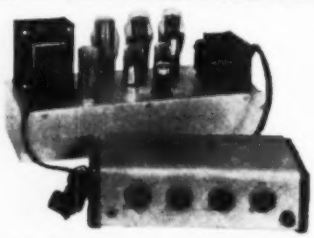

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FIVE RCA BROCHURES

On written request to the *RCA* Engineering Products Department, *RCA Victor Division*, Camden, New Jersey, this company will send its five new booklets on the latest equipment developed in the microphone, recorder, and loudspeaker fields.

Form 2J-4864 is a 20-page illustrated booklet on broadcast microphones and accessories, covering AM, FM, and TV equipment, and presenting all features, uses, descriptions, and performance data on more than 40 items. Form 2J-4910 introduces the new portable and studio tape recorders, while Form 2J-4784 contains complete information on the Type 73B high-fidelity professional recorder. A lightweight, remote amplifier, Type BN-2A, is described in Form 2J-4770, while the recently developed Type LC-1A duo-cone monitoring loudspeaker is illustrated with complete specifications in Form 2J-4771.

H-B INSTRUMENT CATALOGUE 15

A 40-page publication of the *H-B Instrument Company*, 2633 Trenton Avenue, Philadelphia 25, Pa., contains a complete cross indexing and new, systematic layout, making it easy to find instruments suited to one's particular needs.

Besides the specification and general information on psychrometers, hygrometers, barometers, thermo-regulators and relays, there is a temperature conversion table, an alphabetical index and a thermometer index by temperature range. —30—

IMPORTANT COMMUNICATIONS ADVANCE CLAIMED BY ARMY SIGNAL CORPS

RECENTLY the U. S. Army Signal Corps predicted that a new discovery in the processing of quartz crystals, important in the communications industry, will bring substantial economies to both government and commerce. In addition, its discovery may make it possible to crowd more radio and television channels together, one into the other.

Quartz crystals are used in electronics to stabilize frequencies. Without them, radio and television stations would have trouble in always transmitting on their assigned frequencies. These crystals deteriorate, however, and the new process, discovered by scientists of the Frequency Control Branch of the Fort Monmouth, N. J., Signal Corps Engineering Laboratories, virtually eliminates this aging characteristic.

The process involves placing finished blank crystals on a conveyor belt, similar to an automobile assembly line, and drawing them through an electrically heated oven for periods of from two to three hours; they are then subjected to exactly controlled cooling for 24 hours.

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Arthur C. Prichard and Dr. David G. McCaa, Signal Corps Engineering Laboratories physicists, examine crystals processed at Fort Monmouth by the new method.

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1C6	1.28
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1R4	1.06
1R5	.80
1S4	.96
1S5	.72
1T4	.80
1T5GT	1.06
1U4	.80
1U5	.72
1V	.88
2A3	1.28
2A4G	1.28
2A5	.88
2A6	1.06
2A7	1.06
2B7	.88
2V3G	1.98
2X2A	1.25
3A4	.39
3A5	1.49
3A8GT	1.98
3B7	.36
3D6	.36
3LF4	1.28
3Q4	.88
3Q5GT	.96
3S4	.80
3V4	.80
5AZ4	.50
5R4GY	1.15
5T4	1.28
5U4G	.60
5V4G	.96
5W4	1.06
5W4GT	.66
5X4G	.72
5Y3GT	.42
5Y4G	.60
5Z3	.72
5Z4	1.06
6A3	1.28
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6A7	.80
6A8	.80
6A8GT	.80
6AB5/6N5	.88
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6AD6	.85
6AD7G	1.25
6AF6	1.28
6AG5	1.06
6AG7	1.28
6AH6	1.56
6AJ5	.99
6AK5	1.56
6AK6	.96
6AL5	.80
6AL7GT	1.06
6AQ5	.80
6AQ6	.72
6AQ7GT	.88
6AR5	.66
6AS7G	4.95
6AT6	.60
6AU6	.80
6AV6	.60
6B4G	1.28
6B5	1.56
6B6G	.88
6B7	1.28
6B8	1.28
6B8G	1.28
6BA6	.80
6BE6	.72
6BG6G	1.92
6BH6	.80
6BJ6	.80
6C4	.39
6C5	.66
6C5GT	.66
6C6	.80
6C7	1.28
6C8G	1.28
6D6	.66
6D8G	1.28
6E5	.85
6E6	1.06
6F5	.66
6F5GT	.66
6F6	.80
6F6GT	.66
6F7	1.06
6F8G	1.28
6G6G	1.06
6H6	.60
6H6GT	.60
6J5	.54
6J5GT	.54
6J6	1.16
6J7	.80
6J7GT	.80
6J8G	1.28
6K5GT	.96
6K6GT	.60
6K7	.66
6K7GT	.66
6K8	.96
6K8GT	.96
6L5G	1.06

Type	Price
6L6	$1.42
6L6G	1.16
6L6GA	1.16
6L7	.96
6L7G	1.16
6N6G	1.56
6N7	.96
6N7GT	.96
6P5GT	.96
6Q6G	1.06
6Q7	.80
6Q7GT	.72
6R7	1.06
6R7GT	1.06
6S7	1.28
6S7G	1.28
6S8GT	1.06
6SA7	.66
6SA7GT	.66
6SB7Y	.88
6SC7	.72
6SD7GT	.49
6SF5	.66
6SF5GT	.72
6SF7	.80
6SG7	.80
6SH7	.39
6SJ7	.66
6SJ7GT	.66
6SK7	.66
6SK7GT	.66
6SL7GT	.96
6SN7GT	.88
6SQ7	.60
6SQ7GT	.60
6SR7	.72
6SR7GT	.72
6SS7	.66
6ST7	.88
6SV7	.88
6T7G	1.24
6U5G5	.72
6U6GT	.72
6U7G	.72
6V6	1.28
6V6GT	.80
6W7G	.88
6X4	.60
6X5GT	.60
6Y6G	.96
6Y7G	.88
6Z7G	1.28
6ZY5G	.88
7A4/XXL	.72
7A5	.72
7A6	.72
7A7	.72
7A8	.72
7AD7	1.06
7AF7	.72
7AG7	.88
7AH7	.88
7B4	.72
7B5	.72
7B6	.72
7B7	.72
7B8	.72
7C4/1203A	.39
7C5	.72
7C6	.72
7C7	.72
7E5/1201	1.66
7E6	.72
7E7	.88
7F7	.88
7F8	1.06
7G7/1232	1.06
7H7	.80
7J7	1.06
7K7	1.06
7L7	.88
7N7	.88
7Q7	.72
7R7	.88
7S7	1.06
7V7	1.06
7W7	1.06
7X7/XXFM	1.06
7Y4	.72
7Z4	.72
10	.69
12A	.60
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12A6GT	.29
12A7	1.28
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12AH7GT	.88
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12AT7	1.16
12AU6	.80
12AU7	.96
12BA6	.72
12BE6	.72
12C8	.69
12F5GT	.72
12H6	.39
12J5GT	.39
12J7G	.80
12J7GT	.80
12K7GT	.66
12K8	.88
12K8GT	.96
12Q7GT	.72
12SA7	.66
12SA7GT	.66
12SC7	.72
12SF5	.80
12SF5GT	.80

Type	Price
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12SF7GT	.80
12SG7	.72
12SH7	.39
12SJ7	.66
12SJ7GT	.66
12SK7	.66
12SK7GT	.66
12SL7GT	.88
12SN7GT	.80
12SQ7	.60
12SQ7GT	.60
12SR7	.39
12SR7GT	.39
12X3	.98
12Z3	.88
14A7/12B7	.88
14AF7/XXD	.88
14B6	.88
14B8	.88
14C5	.88
14C7	.88
14E6	.72
14E7	.88
14F7	.88
14F8	1.06
14H7	.88
14J7	1.06
14N7	1.06
14Q7	.88
14R7	.88
14S7	1.06
14W7	1.06
14X7	1.06
14X4	.88
19	1.28
19T8	1.56
22	1.28
24A	.88
25A6	1.06
25A6G	1.06
25AC5GT	1.16
25L6GT	.66
25Y5	1.16
25Z5	.80
25Z6GT	.60
26	.72
27	.60
28D7	.39
30	.39
31	.39
32	1.28
32L7GT	1.28
33	.39
34	.38
35/51	.80
35A5	.72
35B5	.80
35L6GT	.66
35W4	.46
35Y4	.72
35Z3	.72
35Z4GT	.60
35Z5GT	.50
36	.39
37	.39
38	.39
39/44	.39
41	.66
42	.66
43	.66
45	.66
45Z3	.60
45Z5GT	.72
46	1.06
47	.98
49	.88
50	1.56
50A5	.88
50B5	.66
50L6GT	.66
50Y6GT	.72
53	1.06
56	.72
57	.80
58	.80
59	1.06
70L7GT	1.56
71A	.80
75	.66
76	.66
77	.66
78	.66
79	.88
80	.46
81	1.56
82	1.06
83	1.06
83V	1.28
84/6Z4	.72
85	.88
89	.72
89Y	.39
117L7GT	1.56
117M7GT	1.56
117N7GT	1.56
117P7GT	1.56
1172Z3	.60
117Z4GT	1.16
117Z6GT	.96
FM-1000	1.28
UX120	1.38
UX200	1.28
9001	.89
9002	.39
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9004	.49
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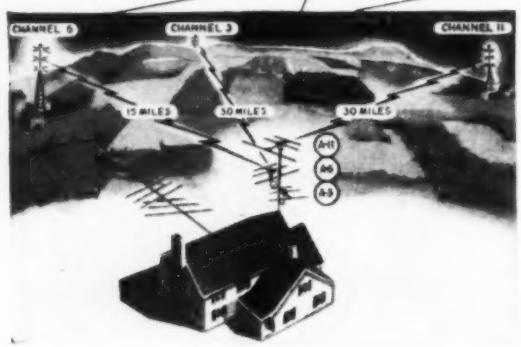

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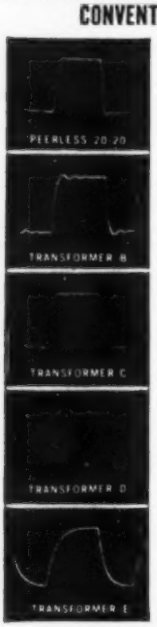

Photos show square wave response with 11,000 cycle fundamental frequency

Square waves provide the most rigorous test of an audio system and give indisputable evidence on transformer performance. These square wave tests were made under conditions simulating actual transformer operation, that is, square waves were fed from a balanced generator through resistors equivalent to the plate load of the tubes. A non-inductive resistance load was used on the secondary. All transformers were demonstrated under identical conditions. No compensation of any kind was used. A switching mechanism was arranged to give an A-B comparison between any of the transformers. All competitive transformers (as well as the Peerless transformer used) were selected from jobber stock items of leading transformer manufacturers. Only the highest priced "high quality" transformer of each manufacturer was chosen. Equally decisive comparative results were obtained at all other frequencies from 20,000 down to 20 cycles.

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GE VARIABLE RELUCTANCE CARTRIDGE

SEE PAGE 27

Servicing Intermittents

(*Continued from page 68*)

change in grid bias, or a good mica condenser can be shunted across the suspected one. Intermittently noisy mica condensers can also be located with an audio signal tracer.

In newer sets, bad connections are common, but the trouble may be delayed for a few years. Visual inspection, aided by pushing each connection with an insulated prod, is usually sufficient. The different types of trouble brought about by bad connections are so numeous it is safe to say that anything can happen. Disturbance in the oscillator section may be caused by insulation being left on the coil wire where it was soldered to the lugs. A defect of this type may be uncovered by isolating the oscillator stage with the v.t.v.m. and checking the coil resistance with an ohmmeter. A buzz in the receiver at high volume may mean the wire from the ground terminal to chassis is just touching the terminal connection; with higher volume, the chassis will vibrate enough to break the connection.

A set that "just dies out once in a while" may have a socket with too large a clearance on one filament contact. Pinching the contact to make the opening smaller is the only adjustment necessary.

Older sets may have screw or nut and bolt connections loose whether from age or banging around, causing intermittent trouble. Using the signal tracer or v.t.v.m. to isolate the stage, tighten those screws or nuts to which connections go from the stage.

With all of these tests and step-by-step detection methods, it is entirely possible that a service technician may be baffled occasionally by the problem of "intermittents." However, these freakish problems do recur, often many times over, and the technician with practical experience to back up his knowledge will, in most cases, be able to isolate the various troubles as they come up, without too much difficulty or waste of time. —30—

RMA FALL MEETING PROGRAM

IT has been announced that program arrangements for the Radio Fall Meeting of members of the RMA Engineering Department and the Institute of Radio Engineers, scheduled for October 31 and November 1 and 2, at the Hotel Syracuse in Syracuse, N. Y., are virtually complete.

There will be two sessions devoted to television, a session sponsored by the IRE Professional Group on Audio Techniques, a session emphasizing quality control, the usual Fall Meeting Dinner with a popular radio man as speaker, and the other features which have made previous meetings so popular. Many speakers well known to radio engineers have been scheduled for the technical program, and their subjects will cover a wealth of engineering information. —30—

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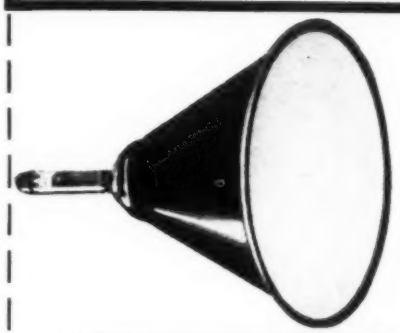

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12SK-7	39c	12J5GT	21c
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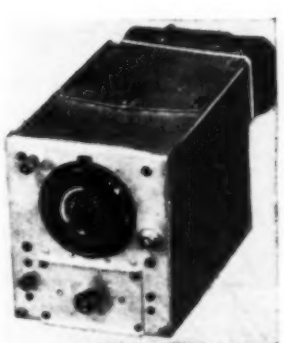

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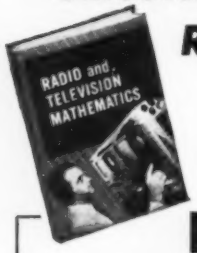

1. Fischer's

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Save time and trouble. In this new book you can *quickly* find the solution of any mathematical calculation required in radio or television work, as, for instance, the factors in distortion, television focus control, antennas, etc. Whenever you are "stuck" on a problem, look in this book. Its complete index shows you immediately where to turn for the answer you want.

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MARS Station of the Month

MARS BEAMS WEEKLY BROADCASTS

MARS—Army Headquarters station, WAR, located at the Pentagon Building, Washington, D. C., broadcasts a weekly message each Tuesday at 0100Z and at 0400Z. (This is Monday at 8 p.m. and 11 p.m., Eastern Standard Time; Monday at 7 p.m. and 10 p.m., Central Standard Time; Monday at 6 p.m. and 9 p.m., Mountain Standard Time; and Monday at 5 p.m. and 8 p.m., Pacific Standard Time.)

Simultaneous broadcasts are made on frequencies 6997.5 kc., 14405 kc., and 20994 kc. Each message is sent three times, once at 10 words per minute, once at 15 words per minute, and once at 20 words per minute.

Designed especially to transmit quasi-official traffic and training information to MARS members, the broadcast offers an excellent opportunity to all amateurs in building up their code proficiency.

WINNER of the MARS Station of the Month award for October is Colonel E. S. Van Deusen, W3ECP-A3ECP, of Washington, D. C., according to Captain E. L. Nielsen, Chief, MARS-Army.

The Colonel's interest in radio dates back to the year 1908 and his boyhood at Fort Plains, New York. Articles appearing in "Modern Electrics" magazine fired the enthusiasm of the youthful Van Deusen. He acquired a Ford spark coil and a work bench and was started on his hobby. Two years later he had a two-inch spark coil, but it was not until 1911 that he made his first contact—one-third of a mile across town.

The "typical" ham shack at his Chevy Chase home today is a far cry from the boyhood workshop where the retired colonel, Quartermaster Corps, U. S. Army, first embraced amateur radio.

W3ECP receivers are store-bought jobs—a DB 22A, a HQ129X, and a SX16. But the xmtrs are Van Deusen variations. A homegrown 10-meter rig sits atop the final stage which is a pair of push-pull 809's with up to 250 watts input. The modulator deck is a pair of 6L6's with 50 watts input. The power supply is a 600-750 volt supply. There is a dual bias supply, and 750-1000 volts for the final.

There is a BC 221 frequency meter, a BC 453 "Q5er" with power supply and speaker, a single speaker, and a v.f.o. exciter.

The exciter consists of a 6SK7, a 6AG7 "Class A" amplifier, a 6F6 (plate tuned), a 6V6 (used as doubler or as xtal oscillator), and an 807 final driven by either the 6F6 or 6V6 and link-coupled to drive the 809's.

Antennas are a 132 foot, a 66 foot, and a 33 foot, all flat-top, end-fed, thirty-five feet in the air, and an indoor one-half wave 16½ feet for the 10-meter rig.

Colonel Van Deusen is a member of MARS and the American Radio Relay League.

He is a route manager for the

Colonel "Van" enjoys a QSO at his home station in Washington, D. C.

Maryland-Delaware district, ARRL, former editor of the Washington Radio Club's "DC Notes," member of the BPL, Rag Chewers, ORS; TLAP, Traffic Outlet Net, and AEC.

Tracing the operating history of W3ECP — the Van Deusen family moved to Syracuse, New York, where the Colonel received his formal schooling. World War I came along, and the amateur radio hobby was put aside in favor of an all-expense trip to Europe as a part of Uncle Sugar's American Expeditionary Force.

After the hostilities were over, the young soldier found himself in Koblenz, Germany, stationed in the same compound with an Armed Forces Signal Unit. Needless to say, the radio bug bit again; by the time Van Deusen returned to the States in 1922, he was adept at building receivers, a fact which many of his friends soon found out.

"Then," the Colonel says, "I got married and started to raise a family. That was the end of most of my workshop time. However, I kept my hand in with traffic nets and the old Army Amateur Radio System."

In 1933 the Colonel was licensed as W3ECP at Camp Holabird, Maryland. He has operated from Camp Holabird, Yeadon, Pennsylvania, and Washington, D. C., ever since.

W3ECP is known to message handlers everywhere as a c.w. man. However, he points to his station logs as proof of the fact that no one enjoys a good phone contact more than Colonel ("Van") Van Deusen.

-30-

Audio Service Techniques

(*Continued from page* 73)

first audio amplifier grid so that oscillation results. This oscillation may be above audibility so it can't be heard. It can be of sufficient amplitude to overload the entire audio system so that the audio signal does not have a chance, to start with, and will be badly distorted even at low levels. If an output transformer is replaced it must be phased right in a circuit containing negative feedback, or oscillation will surely result. This oscillation in many cases, will be above audibility.

The receiver may be overloaded by an inadequate low pass filter in the detector output circuit. The r.f. signal voltage appearing across the detector output should be bypassed to ground. If this condenser is open or too small, the first audio amplifier may have too high a voltage applied to its grid.

As we have seen, aside from the every-day servicing and testing uses, these instruments are invaluable when new circuits are being developed, and you, as a regular user, knowing your scope, oscillator, and voltmeter inside out, will find these instruments a considerable help in analyzing your circuits.

-30-

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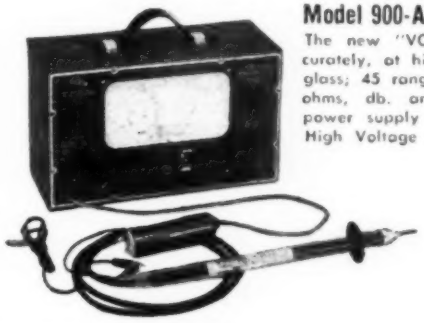

Model 900-A "Vomax"

The new "VOMAX" makes TV, FM, and AM measurements accurately, at highest meter resistance. Giant meter, non-breakable glass; 45 ranges, new single probe for a.c., d.c., a.f., r.f., volts, ohms, db, and current measurements. "VOMAX" measures TV power supply potentials up to 30 Kilovolts when used with the High Voltage Adaptor Probe. A world-beater at only $68.50 net.

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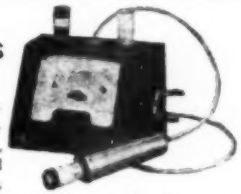

Model 915 Tubeless Grid Dip Adapter

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Model 906 FM-AM Signal Generator

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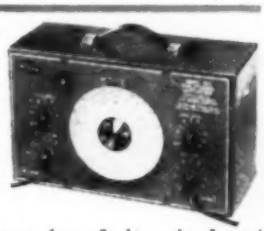

Model 911 TV/FM Sweep Generator

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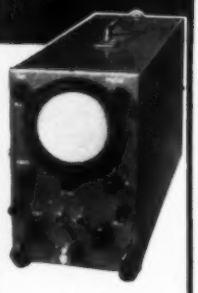

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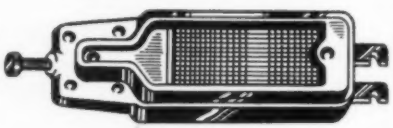

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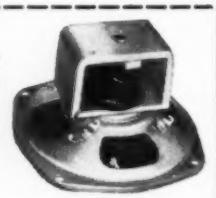

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The TV Freeze

(Continued from page 38)

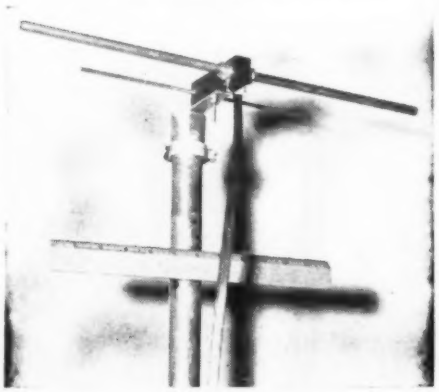
hills, buildings, water towers, etc., in the path of the signals will block the passage of the signals more effectively. Engineers say that the shadows cast by these obstructions will be blacker. This is merely a reference to the effect obstructions have on light—the bigger the object the more completely it acts to block out the passage of light.

This blocking effect is accentuated from the largest to the smallest object—from high hills and large buildings to trees and even high shrubbery. Each of these objects absorbs some or all of the passing u.h.f. television signal, leaving less for the television set to receive. At the ultra-high frequencies—more than at the present frequencies—placement of the antenna as high as possible to obtain an unobstructed signal path to the transmitter—is important.

Working against the height requirement is the fact that, as the frequency increases, the attenuation introduced by the transmission line increases, too. A typical example is the RG-59/U coaxial cable, so widely used by television installation men on Channels 2 to 13. At 100 mc., the attenuation of this line, per hundred feet, is 3.75 db. At 400 mc., this attenuation increases to 8.3 db. and at 900 mc., it becomes 13 db. In terms of voltages, an 8.3 db. attenuation means that the signal reaching the receiver is reduced 2.6 times, or roughly less than one-half of the voltage received by the antenna reaches the set. At 900 mc., a 13 db. attenuation reduces the voltage 4.5 times, or less than 25 per-cent of the antenna voltage reaches the receiver. The inference from all this is quite clear—keep the length of the feed-in line as short as possible—which limits, in turn, the height of the antenna.

U.h.f. signals not only suffer greater attenuation in traveling between the transmitter and the receiver, but even the receiving dipole abstracts less voltage from the traveling wave. The voltage which is developed across

Fig. 10. Dipole and reflector for 6 mc. channel (504-510 mc.). Twelve-inch ruler indicates the relative size of the array.



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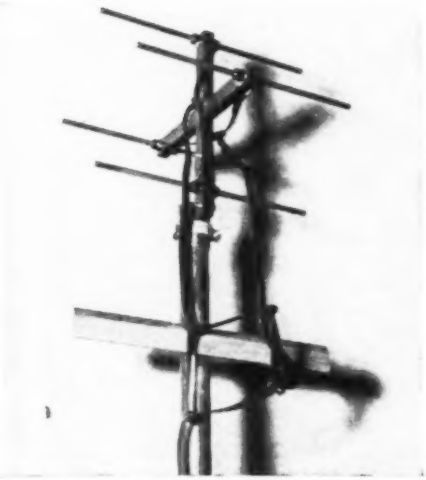

Fig. 11. A specially constructed array designed for a unidirectional response.

a transmission line matched to a half-wave dipole is given by

$$V = \frac{150E}{\pi f}\sqrt{\frac{Z_c}{R_r}}$$

where V = voltage on the transmission line, in millivolts
E = field intensity in millivolts per meter
f = frequency (in mc.) of the received signal
Z_c = characteristic impedance of the transmission line
R_r = radiation resistance of the half-wave dipole.

From this equation, the voltage V on the transmission line is inversely proportional to f. Thus, as f increases, V decreases. The only way to overcome this decrease in voltage induced in the antenna is by using more elaborate arrays or by increasing the radiated power. From tests conducted by *RCA*, it was indicated that tremendous amounts of power would be required at the u.h.f. to produce the same type of coverage that is now enjoyed on the low channels. One example quoted was that at 510 mc., the power had to be increased 550 times over that employed at 67.25 mc. in order that usable signals be received at 70 per-cent of the receiver locations that would be as great as that enjoyed at 70 per-cent of the receiver locations at 67.25 mc. At 910 mc., the power ratio required increases 3000 times to achieve the same conditions. Even assuming a moderate radiated power of 3000 watts at 67.25 mc., we would need 1,650,000 watts (1.65 megawatts) at 510 mc. and 9 million watts (9 megawatts) at 910 mc. Since none of these values are obtainable using present equipment, we can expect to see more complex arrays in use at the u.h.f. band. Fortunately, the size of the antenna is small (12½ inches for a half-wave dipole at 475 mc. and 6½ inches at 890 mc.), and a complex array need not be very large physically. In the tests conducted by *RCA*, some of the antennas used are shown in Figs. 1, 10, 11, and 12. None of these units, except perhaps that shown in

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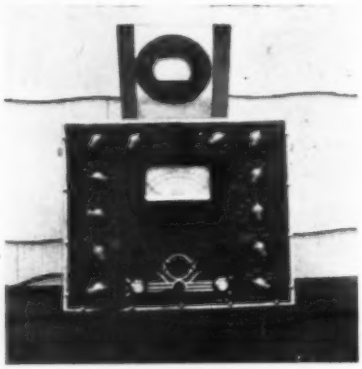

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SEE PAGE 27

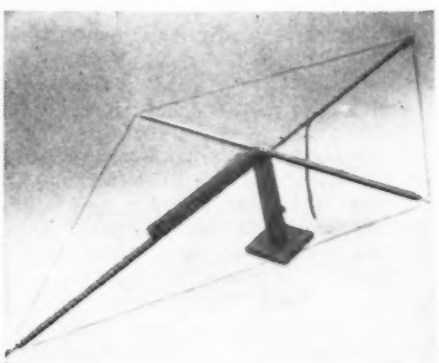
Fig. 11, is very elaborate but this was due primarily to the fact that most of the receiving locations were situated within 7 miles of the transmitter. At more distant points it can be expected that highly elaborate and directional arrays will be used.

The television service technician can expect to find a greater number of dead spots within any area than is now encountered. These dead spots, where the signal is too low to produce a usable picture, will generally be in the shadow of some large obstruction. Even at points where the signal level is high, it will generally be found that careful observance will have to be given to antenna placement in order that the best possible picture be obtained. In this respect, placement of the antenna will be more critical than it is now when several different stations are to be received. It is not at all unlikely that in the u.h.f. band, each installation will require more separate antennas than we require now. This will be due to the criticalness of the rays arriving at the location rather than the fact that the stations are operating at different frequencies. At the ultra-high frequencies, interference arising from man-made contrivances such as ignition systems, electrical motors and generators, neon signs, etc., is considerably less than in the v.h.f. region. This obviously will aid the service technician and, in many instances, offset somewhat the criticalness of antenna location.

The amount of multipath propagation at the u.h.f., which results in the formation of ghost images, depends upon several factors. If the signal level is high and the receiving and transmitting antennas are located in an area containing tall buildings, then in general, more ghost signals will be observed at u.h.f. than at v.h.f. However, where the terrain is fairly level, very little trouble was encountered from multipath wave travel. As the frequency of the signal rises, the number of ghost signals increases, which means that at the upper end of the u.h.f. band more care will be required in antenna placement than at the low end. The situation is further complicated when several stations are to be received and will tend again to lead to more than one antenna per installation.

—30—

Fig. 12. Rhombic antenna for u.h.f. regions.



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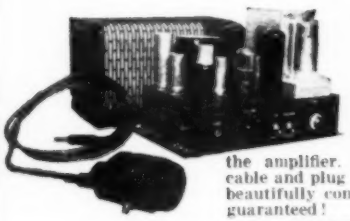

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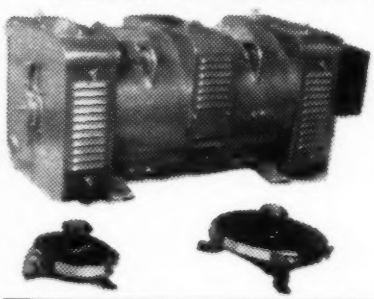

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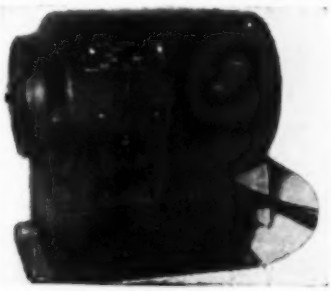

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6100	6940	7973	5725	5875	6406	6673	7373	8040
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2A7	.88	6N6G	1.28	12SJ7GT	.60	485	.49
2B7	.59	6SF5	.60	12SK7GT	.49	954	.50
2S 4S	.49	6SH7	.72	12SQ7GT	.54	955	.55
5V4G	.88	6SJ7GT	.49	12SR7	.72	957	.55
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NEED HELP?

"THE current issue of your excellent publication carries several letters decrying the c.w. exam. for ham licenses. Examinations for marine radio posts and the armed forces still call for c.w. Are we to believe that these services are 'old fashioned'?

"C.w. communication is frequently possible when static renders the phone station unintelligible. Will disaster wait till the bands are in good shape to strike? The team of horses is often called upon to pull an unfortunate motorist out of the mud or snow, so why speak so poorly of them? No ham looks forward to learning the code, but most of them feel they have really accomplished something when they successfully pass that portion of the exam. and find many uses for it in operating their stations.

"Writers of such letters must have some narrow application of a ham license in mind or else don't know much about the ham setup. Who would want countless phone stations each taking up about 6 kc. of the band on our already crowded frequencies?

"If any of your Canadian readers need assistance, please add my name to that of the 'weary old jerk,' and may that list grow in true ham fashion. You have started a grand movement in support of the world's finest hobby, and I sincerely hope that hams the world over appreciate it.

"Best wishes to you in your very fine contest and keep up the good work with your excellent publication. Oh, yes, more v.h.f. dope please."

Bruce H. Underwood, VE3ANU
R. R. 4, Kitchener
Ontario, Canada

* * *

CODE A PAST ART?

"I HAVE just finished reading 'Letters From Our Readers' in your August issue.

"It seems to be the idea of many people that code is a past art. I think this is just a little overstated. I was a Navy radioman, and code was the main means of communication for ships. I admit that radio teletype and phone are wonderful advancements in radio; however, I have been in plenty of places where neither one was of any value.

"To maintain communication with phone, a person has to hear the other person with a fairly good signal strength. Also, in radio teletype one burst of static can garble the copy. In working with code, the signal strength can be almost zero, and the interference quite high, yet contact can still be maintained.

"I think that if a person wants to join the ranks of hams he should have enough courage and initiative to tackle an obstacle such as code. Here at the Milwaukee School of Engineering where I am a student, we have a ham club, W9HHX, and code classes are conducted for anyone interested in getting his ham ticket. All of those fellows consider it an honor to be prospective hams, and are earnestly working to learn code. Anyone can pick up a mike and press the button and start talking—but not everyone can sit down and pound a key! I, myself, am all for code."

J. Edward Boyd, W9HXV
2509 N. 26th St.
Milwaukee 6, Wisconsin

* * *

ALL FOR CODE

"MR. PRUCHA (August issue, Letters From Our Readers) evidently has never tuned in the thousands of manually-operated code stations outside the amateur bands, or he wouldn't say 'the days of the fist are gone.'

"Persons who know very little or nothing about a subject should not feel so authoritative in their criticism. I think it's pretty well established that all rules and regulations governing ham radio are sponsored by amateurs, whether they be in the FCC, ARRL, or some other organization. Further, if a vote were taken, I am quite sure you would find 90 per-cent or more of the amateurs are in favor of the code test.

"If Messrs. Prucha, Ryan, and the others ever sat down and worked a few of the boys on c.w., using a crystal oscillator running 5 to 10 watts, and then tried the same thing on phone, they would soon learn why the code is an essential part of ham radio.

"Fill the ham bands with phone rigs, and ham radio will lose the real, conscientious 'ham' who made this a hobby instead of a sport."

Jack Watt, W8HYQ
Ontonagon, Mich.

* * *

CODE HINDERS FELLOWSHIP?

"I WAS particularly interested in reading the letters in the August issue from John Ryan and R. V. Prucha in reference to abolishing the code for amateurs. The code requirement has been a thorn in the side for many, and I also am in favor of doing away with this antiquated form of communication.

"If the foremost amateur radio organizations in the U. S. would submit proposals to the FCC making the code optional, I think they would eventu-

ally agree. The FCC acts on all proposals submitted by these organizations.

"For a long time I have been interested in becoming an amateur operator but could not arouse any desire to learn an uninteresting phase, and I am sure others feel the same as I do. Just recently I read proposals submitted to the FCC by amateur organizations and found that every license is governed by a code requirement. When the new Citizens' Band was authorized by the FCC, these same organizations were against the action partly because there was no code requirement. When you read things of this nature, it begins to add up to the fact that the leading amateur organizations are against abolishing the code requirement from examinations.

"Amateur radio promotes fellowship between all nations, and one way to promote this fellowship still further is to abolish code for all those would-be amateurs who find this very unnecessary requirement a block to having their own stations.

"Let those that want the code have it, but some consideration should be shown those who wish it eliminated."

Carroll H. Weyrich
2800 Alden Road
Parkville 14, Maryland

* * *

FUTURE HAM QUOTES

"SOME day in the near future, I hope to be a ham.

"Maybe I am old-fashioned (not because of age, as I am only 15 years old), for I want the code test to stay. I say this because we beginning hams won't have a chance on the phone bands, mainly because of the price of the equipment. Besides, most of us like the test because it challenges us to something we know we can be proud of.

"Please let me live for writing this because I sure want that wonderful little ticket. I am going to write to one of those boys who want to help us beginners because I do need help."

James W. Poole
Box 431
Front Royal, Va.

* * *

CODE IS IMPORTANT

"MAY I take up some of your valuable space and time to get in my two cents' worth regarding code in the ham license exam. Some of the writers in 'Letters From Our Readers' cause my blood to boil because in my estimation the code exam. is a most essential part of a ham license.

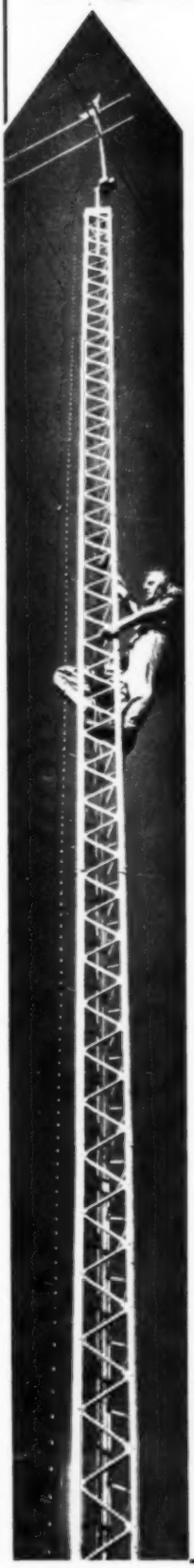
"I believe that all those who wish to see the code exam. abolished are in two classes: Those just too lazy to learn, and those who do lack the coordination necessary between head and hand. John Ryan should be made to realize that code is no toy, but the basic art of radio communications, and the most reliable means of communication where consistent operation is demanded.

"If there were no code exam., there

--ALPRODCO--

TOWERS of "aircraft" ALUMINUM

ASSURES SPARKLING RECEPTION for TV FM AM



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ONLY 115 PER FOOT

- **Weight** of one pound per foot assures safe, easy installations.
- **Available** in knocked down or factory assembled six foot sections.
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Part No.		Dealer net price
T-6	Standard 6' Tower (knocked down)	$6.91
AT-6	Standard 6' Tower (assembled)	8.56
MK-1	Mast Kit, including top angles and mast bracket	1.80
B-1	Hinged Base Plate	2.10
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TRYLON Announces

... THE FIRST PRACTICAL, EASY-TO-INSTALL, LOW COST TV MAST

- Easy to handle—easy to climb
- Mounts any type of TV antenna
- 40' Trylon mast and antenna installed by 2 men in 3 hours or less—at mast cost of about $1 per foot!

Now you can get all the height you want for TV antennas—at little more than the cost of makeshift mast devices—and twice as easily installed! Trylon TV Antenna Masts are made in handy 10' sections. They weigh only about 2 lbs. per foot! Sections can easily be joined for mast heights of 20', 30', 40', 50' or 60' as desired. Triangular in shape, formed of double-welded "serpentine" steel rod construction, they can be mounted on either flat or peaked roofs and climbed like a ladder. Clamp-on working platforms are available for installation or adjustment of antennas. Safe, durable, fully tested in numerous installations.

WRITE TODAY!

Folder and price list giving full details of Trylon TV Masts and accessories now available. Write today. One out of every 4 TV users is an immediate prospect!

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WEST CHESTER • PA.

would be an influx of inadequately equipped hams, and the bands would be so cluttered that chances of working anyone would be remote. Thus, code does limit new members to those who are properly trained operators. I know, I have some friends who would like to be hams, but the code exam. (10 w.p.m.) holds them up. It just boils down to 'Give me something easy. I don't want to work.'

"Let's face facts. Code is important. The exam. makes the ham progressive and teaches proper operating. If anyone thinks I am tooting my horn only for c.w., they are wrong. I took the trouble to increase my code speed so that I could enjoy all band phone privileges."

Tom Stacey, VE2XB
713 Irelle Ave.
Verdun, Quebec, Can.

* * *

C. W. IS SIMPLE

"AFTER reading several gripes in your August issue about the code examination for a ham ticket, I wondered if these fellows were afraid they might have to learn something.

"I am 15 years old and haven't been licensed very long, but I have found c.w. a very efficient and inexpensive means of communication, especially in handling traffic. I feel that if these men were genuinely interested in ham radio, they wouldn't spend so much time beefing over a little test but would settle down and learn a comparatively simple but useful thing.

"Not denouncing phone operation, I do say, let's keep ham radio on an equal basis for all, huh?"

Dick Rucker, W5PZD
23 College Circle
Stillwater, Okla.

* * *

HAM RADIO A SERVICE

"REGARDING the August 'Letters From Our Readers,' I'd like to point out a few facts. First, amateur radio is classified as a service, and there are two major reasons why. It provides efficient communication facilities in emergencies when commercial lines are inadequate, and it provides a pool of trained operators and frequencies for the military in time of war.

"Second, a c.w. station costs less to build, less to operate, and for a given amount of power the effective range of c.w. is greater than other forms of transmission. Because of lightweight, simple construction, and the ease with which code messages may be transmitted, radiotelegraph equipment is universally employed at battalion and regimental levels. Finally, by actual performance in Army schools, it was demonstrated that nearly everyone is capable of learning the code; the percentage of those unable to grasp it was minute.

"Here is another factor in obtaining maximum use of the bands. Stations using A-1 emission require less band space, and can be copied through each other if slightly spaced. Ten c.w. stations can operate in the same spectrum space necessary to accommodate one phone station.

"I also want to use this opportunity to praise the article in 'Mac's Radio Service Shop' for April, 1949. I read it several times, and also to anyone I could get to listen."

D. H. Skatzes, W8OUR
R. 4,
Athens, Ohio

-30-

Fair Trade?

(*Continued from page* 41)

mally do. Fair Trade does, however, permit the manufacturer to know that his goods will be sold at the Fair Trade price and that he can keep his faith with legitimate dealers by using the law to enforce observance of this price.

In fact, the effect of Fair Trading has been to keep prices considerably below the normal trend. To quote John W. Dargavel, Secretary of the National Association of Retail Druggists:

"Above all, Fair Trade has enabled the drug industry to achieve a price performance in the public interest, unequalled, to my knowledge, in any other industry. By 1939, over-all prices in the drug field, under Fair Trade, had dropped one per-cent from pre-Fair Trade, depression prices. This was revealed by a study made by staff members of the University of Minnesota's School of Business Administration and published by the Druggists Research Bureau in 1940. The study analyzed the effects of Fair Trade on the prices of 50 leading trade-marked products in 42 Fair Trade states.

"During the war and postwar inflation, an unprecedented 'holding of the price line' was achieved. The Fair Trade prices of 7334 drug products rose only 3.1 per-cent in the period between 1939 and 1947, according to a study made by the National Association of Chain Drug Stores. During this same period, Bureau of Labor statistics showed that food prices have risen 93 per-cent; household products, 81 per-cent; the over-all cost of living, 59.3 per-cent; miscellaneous items 38.5 per-cent; and drug products as a whole, 15.4 per-cent."

Third, it should not be felt that Fair Trade is a new vehicle of government control, as is sometimes suggested. As we pointed out previously, Fair Trade merely *permits* the manufacturer or vendor to establish a minimum price and gives him the power to maintain it, if he chooses to do so.

Fourth, Fair Trade laws are merely to encourage *fair* trading and should be thought of as rules necessary to maintain fair competition in distribution, in just the same way that rules are necessary to ensure fair play in baseball, football, or any other group activity.

Predatory, unwarranted, uncontrolled price cutting is "cheating" of the most vicious sort and will erode

RADIOMEN'S HEADQUARTERS WORLD WIDE MAIL ORDER SERVICE!!!

$9.95 TAKES ALL THREE BIG BARGAINS "B"

HOME WORKSHOP AT BARGAIN PRICE. Accurate and precise 2 speed guaranteed hobby lathe, the essential machine for the home workshop. Sturdy enough for light production work or factory standby service. Supplied with 56" of belting for connecting to any available electric motor or power take-off. Also included in this unbelievable offer are such accessories as a ½" drill chuck with specially hardened tool steel jaws, a 4" electric furnace high speed grinding wheel, a cotton buffing wheel with a large supply of buffing compound, and a 4" steel wire scratch brush. Your cost **$6.00.** Sole export agent. Distributor inquiries invited.

SENSATIONAL, FASCINATING, MYSTERIOUS SELSYNS. Brand new Selsyns made by G. E. Company. Two or more connected together work perfectly on 110 V A.C. Any rotation of the shaft of one Selsyn and all others connected to it will rotate exactly as many degrees in the same direction, following unerringly as if the units were connected to either by shafting instead of wire. This is true whether you twist the shaft of the master unit a fraction of a revolution or many revolutions. Useful for indicating direction of weather vanes, rotating directional antennas, or controlling innumerable operations from a distance. Complete with diagram and instructions. Per Matched Pair, **$4.95.**

STROMBERG CARLSON

Power Switching Relay Box. Neat 3½x4x5½" Steel case with light fitting cover finished in Stromberg's usual beautiful chocolate color crackle finish..... **$1.00**

Battery type BA38. 103.5v. battery used in handytalkies and mine detectors. 1x1x1½ Outdated but test OK. **$1.98**

standard type normally open

MICRO SWITCHES **39c**

leaf actuator SPDT MICRO SWITCHES **49c**

Brand new fully shielded GE single button mike transformer in beautiful silver finish case **99c**

Television 300 ohm twinline, per 500 ft. spool **$9.95**

Miniature bayonet pilot light socket—per hundred **$2.50**

Universal 4 lead broadcast band oscillator coil can be converted to 3 lead type by addition of jumper;

Six for **$1.00**

Brand new motor driven band-switching turret with slug-tuned 2¼ silver wire coils on ceramic forms and air trimmers. 100 to 160 MC. A steal at..... **$2.98**

HEAT GUN

Streamlined pistol grip heat gun in vivid red housing that delivers a powerful 20 Cubic Ft. per minute blast of hot air at 160 Fahrenheit—Ordinary blowers have small fan motor, but this has a lifetime-lubricated AC-DC motor of the rugged vacuum cleaner type, that produces a hurricane of either hot or cold air. Perfect for blowing out dirt or dust from radio chassis, drying out ignition systems, warming up carburetors, quick-drying paint, thawing out radiators or water pipes, etc. Warning:—Keep this away from your wife, or she will be using it to dry her hair because it will do it in half the time of her ordinary hair dryer, to say nothing of her using it to dry stockings or clothing, or defrost the refrigerator instantly. **Only $12.95.** Satisfaction guaranteed or money refunded if returned prepaid within 5 days.

Foggy Weather Is Here

"SO" RADAR RECEIVER

Complete with 9 tubes including picture tube. This Plan-Position-Indicator Oscilloscope has a self-contained pack designed to run from the 110V. power supply on LST or PT boats. It provides a 5" diameter picture adjustable at will to an 80, 40, 4 or 2 mile circle with the boat at the center, showing location of land, other ships or any obstruction, so that navigation can be carried out in pitch darkness or pea-soup fog with as much safety as in brightest sunlight. Also a natural for adaptation as a television set. Your cost..... **$39.95**

"P.M. SPEAKERS"

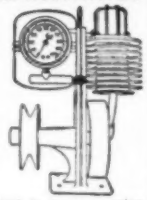
Latest type PM Speaker in a fully-enclosed finished metal cabinet. This speaker and case match communication receivers, and in addition make perfect intercom remote stations. Our price, **$4.50.** Including output transformer **$4.95**

DELUXE SUPERHET A.C.-D.C. Radio Kit

Extra high quality standard production line radio in kit form with complete instructions. Features 2 iron core I.F. transformers, a 2 gang condenser, and polyethylene insulated edgewise wound antenna loop. Tubes include 12AT6, 12BA6, 12BE6, 50B5 & 35W4. Receives broadcast band from 550 to 1700 KC. Kit form **$8.75** or 2 for **$17.00**

Assembled, Wired & Tested **$12.95** or 2 for **$25.00**

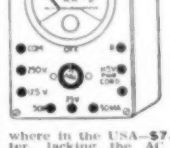
COMPRESSED AIR INSTANTLY *ANYWHERE*



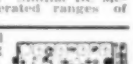
Portable Air Compressor and storage tank. Ruggedly built of best materials using lifetime lubricated ball-bearing on connecting rod and oil impregnated main bearing on shaft. Unusual design forever eliminates valve trouble, the most common fault in air compressors. **PATENTED** unique air intake system increases efficiency tremendously over other compressors so that air output is much greater than that from larger compressors powered by heavier motors. Will deliver approximately 3500 cu. inches of air per minute at maintained pressure of 30 lbs., or will inflate a 90 lb. truck tire in less than one minute. Comes complete with 100 lb. gauge, although finger-tip adjustment allows setting of output pressure at any value, which will automatically be maintained. Works from any ¼ H.P. motor. Useful for spraying paints or lacquers, disinfectants, insecticides, annealing or brazing with natural gas, inflating tires, etc. Price **$14.50** postage prepaid anywhere in the U.S. Efficient, completely adjustable syphon type spray gun complete with 12 ft. of 100 lb. tested hose available for only **$7.75** with pint container, also prepaid. 25% required on all C.O.D. orders.

Sensational Value in

AC-DC POCKET TESTER



This analyzer, featuring a sensitive repulsion type meter housed in a bakelite case, represents the culmination of 15 years' achievement in the instrument field by a large company specializing in electronic test equipment. Specifications of the AC-DC Model Volt-Ohmmilliammeter: ACVolts—0-25, 50, 125, 250, DCVolts—0-25, 50, 125, 250, Milliamperes AC—0 to 50, DC Milliamperes—0 to 50, Ohms Full Scale — 100,000, Ohms Center Scale—2400, Capacity—.05 to .15 Mfd. Total Price, prepaid anywhere in the USA—**$7.00.** Similar DC Meter, lacking the AC operated ranges of above, **$5.50** prepaid.



RT-1655 crystal controlled SUPERHET RECEIVER that covers the FM band. The ultra modern circuit uses the latest types of tubes. Beautiful chassis and aluminum cabinet. Eleven tubes and schematic supplied **$14.95**

FCC AUTHORIZES RADIO for PRIVATE SERVICE!!!!

(The FCC announced that effective June 1, any American over 18 years of age is eligible for a 5 year station permit. In the "Citizens" band, no code test or technical knowledge are necessary.)

GENERAL ELECTRIC 15 TUBE TRANSMITTER-RECEIVER SET

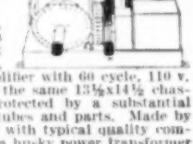
This brand new 15 tube transmitter-receiver was designed for mobile storage battery powered service. It will operate in the "Citizens" band where no amateur license to transmit is necessary. It's a cinch for any experimenter to connect this unit for 110 VAC operation by following the instructions and diagrams supplied, which cover numerous applications, including television. For those intending to use on car or boat, a new dynamotor, exactly as originally supplied, costs only $15.00. Don't fail to write for FREE descriptive bulletin. Order our RT-1248 for only **$29.95**, or two for **$53.90.**

AUDIO AMPLIFIER

Brand new, dual triode amplifier having 2 of the valuable and scarce ouncer type audio transformers that sell for over $10.00 apiece. Neat aluminum case, fully enclosed (largest dimension 6 inches.) Perfect for intercom systems, phono amplifiers, mike amplifiers, or signal tracer amplifier for testing radio sets. A sensational bargain at only ..... **$3.40** each.

RT 1579

with tubes diagram and parts list only $14.95



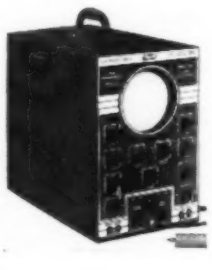
A three stage, cascade 6SJ7's and 6F6 output stage high gain, high fidelity amplifier with 60 cycle, 110 v. power supply on the same 13½x14½ chassis, which is protected by a substantial steel cover over tubes and parts. Made by Western Electric with typical quality components such as a husky power transformer and oil condensers, this unit is obviously intended to give years of trouble-free service with no more need for repairs than a telephone. Disconnecting one wire each, from the special input and output filters, will result in as high a fidelity amplifier as can be obtained.

NEW! INSTRUMENT KITS

at new low bargain prices!

5" OSCILLOSCOPE & STETHOSCOPE

Model TS-7K $46.50 FOR TELEVISION, FM & AM



High quality laboratory 5" oscilloscope plus signal tracer; 2 instruments for price of one. Designed for TV and FM alignment and AM servicing. Has jack for probe listed below. Permits signal tracing in any circuit through phones or screen pattern. These extra features in addition to conventional scope use. Built-in high gain (0.5 V/inch) amplifiers with response to 350 Kc. Complete with all tubes including 5" CR tube. Less probe and head phones. Steel case 15x9½x17½". **$4.25**

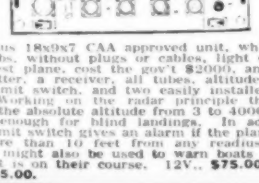
TS-7PK. Probe Kit
TS-7, factory built 89.95
TS-7P, factory built 8.25

DeLUXE SIGNAL TRACER Model TS-3K $22.75

Newest, fastest way to find all radio faults in minutes instead of hours. Gives you "know how" on tougher jobs. Easy to use by expert or beginner. Test parts. Locates causes of fading, distortion, dead sets, etc. Jacks for connecting your present V.O.M. give visual reading on all RF and audio. AC operated. Steel case 8½x12x6". With 4 tubes, probe and service guide.

Model TS-3, factory built **$34.95**

BRAND NEW APN1 14-TUBE ELECTRONIC ALTIMETER



This famous 18x9x7 CAA approved unit, which weighs only 25 lbs. without plugs or cables, light enough for the smallest plane, cost the gov't $2000, and includes a transmitter, a receiver, all tubes, altitude indicator, altitude limit switch, and two easily installed 11" antennas. Working on the radar principle the receiver measures the absolute altitude from 3 to 4000 feet with precison enough for blind landings. In addition the altitude limit switch gives an alarm if the plane's height varies more than 10 feet from any readjusted value. This unit might also be used to warn boats of any obstacle that is on their course. 12V., **$75.00.** 28 volt model, **$45.00.**

MICROPHONES

Super Special-Highest quality all chrome bullet shaped CRYSTAL MIKE of top-flight nationally known brand **$5.95.** Bullet DYNAMIC MIKE — **$7.95,** MIKE Jr.—**60c,** PUSH-TO-TALK MIKE switch on handle—**98c,** LAPEL MIKES—(Specify whether carbon or magnetic) **93c.**

RT1711 Brand New 12 Tube, 110 Volt Receiver-Indicator-Oscilloscope complete with all tubes and power supply. Has telescoping hood over scope tube, which is equipped with a detachable calibrated screen. Has centering and amplitude controls and two video inputs. A natural for television..... **$39.95**

SUPER SPECIAL

FAIRCHILD bombsight **POWER UNITS.** Our quantity of these is too limited to justify the space required by a photo, but each unit is brand new, contains 9 tubes, which alone have a total value of **$15.00;** 8 electric motors or generators, 6 of which are of the permanent magnet field type; relays; and 20 valuable precision resistors plus a multitude of the ordinary kind, in addition to many condensers and potentiometers. All for only **$14.95.** We will ship but one to a customer while our small quantity lasts.

1000 Cycle AUDIO FILTERS

Navy PD52010-1 low pass audio filters as mentioned in the "Masked Audio" article in June CQ, and designated by the above number, are the exact electrical and physical equivalent of commercial audio filter units selling for $35.00 wholesale. They are infinitely better than the surplus "Radio Range Filters" being sold for reducing QRM, and at 2 KC off resonance for example, a 2 section filter using PD52010-1 is capable of twice the selectivity available thru the use of the Q5-er (the BC453 section of the 274N which has provided the amateur's previous highest standard of interference elimination). EXTRA SPECIAL—NAVY PD52010-1 with diagram **$5.00**

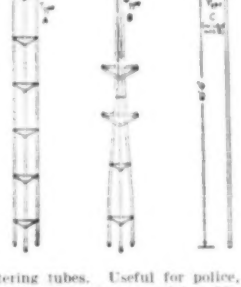
TOGGLE SWITCHES

Order Number

SW-11—Single Pole, Single Throw.. **35c**
SW-12—Single Pole, Double Throw. **45c**
SW-13—Double Pole, Single Throw **57c**
SW-14—Double Pole, Double Throw. **69c**
SW-15—Spar. Double Throw, Center Off **69c**

BUFRAD TOWER

This latest addition to the famous line of BUFRAD antenna products makes up to a hundred foot tower from any desired number of ten foot sections of extremely strong welded construction. The sections are shipped assembled and painted, so that erection is a matter of minutes rather than hours. Assembly is a one man job, and is accomplished by climbing up the completed portion of the tower with the next 25 lb. section to be installed. Hand and footholds are provided to make the work safe and easy. Cap at top of tower, provides bearing surface for rotating, and prevents water from



entering tubes. Useful for police, or amateur transmitters, and in addition the tower will provide satisfactory TV reception where otherwise it would be impossible. Ideal for supporting permanent or temporary power lines, wind generators, stadium public address speakers or spotlights for gas stations or parking lots. "B" and "C" sections together cost a total of $15.75 and total 20 feet. "A" sections, which make up the entire tower except for the top, are each 10 feet long and cost but **$12.75** apiece. Those who wish a mast base will be able to obtain one (not shown above), for only **$6.00.** The base is especially useful when erecting the tower on a sloping roof.

SOS EMERGENCY TRANSMITTER SOS

This is the famous Gibson Girl Transmitter that saved so many lives during the war. It is used as a distress call transmitter on boats and airplanes. The Gibson Girl is the easiest transmitter in the world to operate. No instruction or experience necessary. No external power supply required for operation. It is merely necessary to turn the crank on the top of the transmitter and power is generated and the distress signal is automatically sent out on the international distress frequency. Brand New Gibson Girl transmitter complete with tubes, **$9.95.**

Antenna Kit for Gibson Girl transmitter. This kit was designed to improve the effectiveness of the Gibson Girl Transmitter by increasing the range several times. The kit includes 300 feet of special antenna wire, two balloons for raising the antenna in calm weather, two hydrogen generators to inflate the balloons, a special box kite for antenna erection in windy weather, and a searchlight, powered by the crank operated generator in the transmitter. Complete kit **$9.95.**

ALL PURPOSE NEON TESTER. 60 to 550 volt. Indicate all kinds of current, AC, DC or RF, and comes complete with instruction booklet outlining various tests on radio sets, including the location of fading, dead stages, shorts, and making screen-grid and plate circuit tests. **35c** ea. Per doz. on attractive display card—**$3.50.**

$7.05 TAKES BARGAIN "C"

(All three items below)

ALUMINUM GEAR BOX 18 x 8 x 7 that contains two powerful electric motors and two matched gear trains, 62 gears in all varying in size from ½ to 4 inches in diameter. This unit is readily converted to rotate in beam antenna or any other similar use..... **$5.00**

SIGNAL CORPS INTERCONNECTOR RELAY BOX 730A

This valuable unit, made by Bell, and more familiarly known by the U. S. Army designation BC616, is encased in a highly polished aluminum case 6½ x 5½ x 2½, and contains 150 mfd. of condenser capacity, sensitive relays, resistors, and terminal strips. Order several at the giveway price of only **$1.95.**

REMOTE CONTROL UNIT — Aluminum case 4x3x2 containing 2 potentiometers, triple pole switch, 4 knobs, phone jack, gear mechanism and revolution counter. Including 8 prong JAN connector to fit box—**$1.39.**

BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. RN-8, BUFFALO 3, N. Y.

INVENTORY SALE
ALL PRICES CUT TO BONE

WESTINGHOUSE KUPROX RECTIFIER
0.64 amps—28 volts, Reg. $11.00 ea., SPECIAL..$1.95

25c TUBE SALE—4 tubes min. ≠53-2A7-55-27-01A-85-31 ..... $1.00

12 BRAND NEW 10" PHONO RECORDS—Ass't. Jazz—Pop—Hillbilly—Polkas $1.49

WOOD MIDGET CAB. 8½x5⅞x4¼" 69c

POWER PACK KIT
COMPLETE COMPONENT PARTS for Heavy Duty Power Pack. Made from Signal Corps Brand New Parts—Delivers approx. 350 volts—150 mils. 1 Plate Trans., 1 Filament Trans., 2 Chokes and Schematic Diagram. U. S. Gov't cost over $60. Shipping wt. 30 lbs. SPECIAL PRICE $3.00

TUBE REACTIVATOR KIT
New Electronic Welding Process instantly welds burnt out filaments of 25-35 and 50 volt tubes, thereby saving money and time. Complete wiring diagrams and instructions. Also instructions for repairing 35Z5 tubes. Component, diagram and instructions...$2.95

JONES 20 TERMINAL BARRIER TYPE STRIP... 25c

TRANSMITTING FILTER CHOKES
63 Henries, .018 Amp., 930 Ohms..... 75c

CONDENSERS
CCA 2MFD, 1000V (4¾"x3⅛"x3½") $1.25
CCA 8 MFD, 1000V (7"x6"x4¾") 1.75
DUBILIER 1 MFD, 3000V (5"x7½"x2¾") 2.00
FARADON .125 MFD, 1500V, 2 Amps, @ 30 K.C. (5⅞"x5½"x4") 95c

.00005 MFD, 2500 W. V. D.C. Trans. Mica..... 35c

Signal Corps Phones—2 M. Ohms (8 M. Ohms Imp.) $1.25
2 Ft. Extension Cord (Female Plug) 40c

OIL FILLED FILTER CONDENSERS
1.—MFD—2000 volts ..... 75c ea.
1.—MFD—1000 working volts, 6 for 99c

FAMOUS BRAND RECORD CUTTING HEAD
Size 13/16x27/32 ready to fit your cutting arm or bracket. SPECIAL..... $2.95

TOBE TUBULAR ELECTROLYTICS
20-20 MFD. 150 V. 29c 40-40-20 MFD. 40-40 MFD. 150 V. 37c 150 V. 38c
30-30 MFD. 150 V. 32c
LOTS OF 12 (1 Type) 3c Disc. per Cond.

2½ M.H. R.F. CHOKE COIL—27c ea. 5 for $1.00

3 BAND OVAL DIAL—7½" L x 5½" H..... 79c

100 RESISTOR ASST. ¼-½-1 WATT..... 95c

Low-Loss Short Wave Variable Condensers ⅛" Shaft Type
5 Plate—20 MMFD. 20c
14 Plate—55-60 MMFD. 27c

Lock Type Air Trimmer Variable Condensers
3 Plate—12-15 MMFD. 10c
5 Plate—20 MMFD. 11c
8 Plate—30-35 MMFD. 13c
10 Plate—40 MMFD. 14c
14 Plate—56 MMFD. 20c
20 Plate—80-100 MMFD. 25c
27 Plate—100-110 MMFD. 35c

3 GANG T.R.F. VARIABLE CONDENSERS .000365 Cap. 75c

D.P.D.T. SLIDE TOGGLE SWITCH 23c

2 piece 5-pole Male and Female Separable plug. Both with Flex. Cord. 4 prs. $1.00
35c per pr.

4 PR. WAFER SOCKETS—$1.49 per C. each 3c
PHILCO 4 MF—300 V—1⅜ CAN CONDENSER—10c ea.
W-L—10 W. 1,000 ohm Power Rheostat 29c
5-6 PRONG WAFER SOCKETS ..... $2.50 per C
100 ASST SOCKETS—4-5-6-7 ..... $3.50 per C
1,000 OHM WIRE WOUND POTENTIOMETER 15c
30 HY. FILTER CHOKE SHIELDED 49c
UNSHIELDED 39c
10 WIRE WOUND RES. KIT—5-50 W. ASST 49c
2,000 ohm Wire Wound Rheostats ..... $1 per doz.
CARTER WIRE WOUND C.T. VARIABLE 20 OHM RESISTORS ..... $1.00 per doz.
RCA 6 OHM POWER RHEOSTATS 39c
PHILCO AUTO SUPPRESSORS—$5.00 per C. ..... 7c ea.
GEN. ELEC., WESTINGHOUSE, etc., 60 CYCLE WATT HOUR METERS, slightly used, perfect condition, same as used in your home. 110-125 volts. 5 Ampere ..... $2.95 10 Amps. $3.95

Grind your own crystals—Pure Brazilian Quartz, all sizes and thicknesses—1 lb. package $1.00

340—degree dial with 10 push button attachment—¼" shaft—ideal for Xmitters—Sig. Gen. or Osc. 39c

RCA Band Switches—
3 gang, 3 pos. 3 band. 30c 6 gang, 5 pos. 4-5 band. 40c

I. C. A. 30 MH RF choke 25c

Trimmer-Padder Asst.—all isolantite—singles, dual; triples—100 asst. pieces..... $2.25

5"—450 ohm AC-DC dynamic $1.35
5" 5M OHM RCA SPEAKER 1.00

Philco rotary tap tone control..... 25c

ATTENTION: Prospectors
Explorers for Hidden Treasures!
Construct a U.S. Army Type of Metallic Mine Detector from these U.S. Army Mine Detector Amplifiers. Amplifier unit only (less tubes and batteries) with cables head-bone cord and jack. Army wiring diagram. Type AN PRS-1 ..... $1.95

TUBES—024—79c; 117L7—89c; ≠15, same as ≠224—20c.

10 DRY ELEC. FILTER COND. ASST. $1.10
6 ASST. WET ELECTROLYTIC CONDENSERS 59c

RADIO EXPERIMENTER'S SURPRISE PACKAGE—CONTAINS BYPASS & FILTER CONDENSERS, SHORT WAVE TUNING UNITS, POWER AND AUDIO TRANSFORMERS, SOCKETS, RESISTORS, CHASSIS HARDWARE, OVER 20 LBS. OF VALUABLE PARTS $4.95

DRILLED CHASSIS FOR 5-6 tubes 7"x10"x1¾"—29c; 5"x10"x1½" 25c
RCA ADJUSTABLE CODE INTERFERENCE WAVE TRAP 456-475 K.C. 25c
PHONE JACKS—OPEN & CLOSED AUTO. 18c
NATIONAL 5-15—450 VOLT CAN FILTER CONDENSER 39c
EBY SPEAKER VOL. CONTROL—40 OHMS..... 15c
SALE—PHONO RECORD ALBUMS—SALE
10"—3 comp.—15c; 4 comp.—20c; 12 comp.—49c
12"—3 comp.—15c; 4 comp.—20c; 12 comp.—69c

WESTERN ELEC. TRANSMITTING STEP-DOWN TRANSFORMER—AC, 190, 210, 230, 250 V. W.E. 20 AMP RETARD CHOKE TO MATCH. Wt. 125 lbs. ea. Freight Shipments Only. SPECIAL. $5.00 ea.

MINIMUM ORDER $2.00—NO C.O.D. SHIPMENTS—PLEASE INCLUDE POSTAGE

NEWARK SURPLUS MATERIALS CO.
Dept. OC
324 Plane Street NEWARK 1, N. J.

and destroy any industry in which it is permitted to go uncontrolled.

Fifth, Fair Trade laws may not be used for vertical price fixing within an industry. That is to say, two or more manufacturers *may not* get together with the purpose of establishing similar prices on like products so as to control the field. Such practices are still in violation of the Sherman Anti-Trust Law, are expressly prohibited in State Fair Trade laws.

But now, let us consider for a moment, what the wide-spread application of Fair Trade procedure could mean to the television industry. Can you imagine what it would mean to be able to talk to a prospect and to *know* that he could not go anywhere else and buy the same receiver for 15 to 30 per-cent below list? Can you imagine how much more salesmanship you would be able to use by knowing that price alone would not be the final deciding factor, regardless of what you might say? Can you imagine how much more willing and complete could be your service on a set that you had sold at a legitimate profit, and how much more recommended business would come as a result of such service?

Actually, it would mean a return of the radio and television business to the status of a stable industry promising a good future to anyone who was properly trained and willing to apply himself. Today it has fallen into the hands of cut-throat price manipulators who think only in terms of rapid turn-over and immediate profits (if any!).

Of course, like all dreams, this one is not capable of 100 per-cent realization—for a time at least. But the success of Fair Trading in other fields promises that it *is* possible for the radio industry to gradually build into its fiber the sound elements of price regulation and to eliminate the evils of wide-spread price cutting.

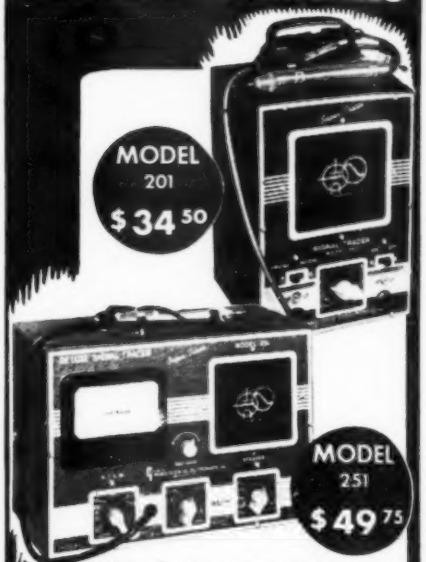
To quote Augustus Wolfman, Editor of *National Photo Dealer* in a special statement made for RADIO & TELEVISION NEWS:

"Fair Trade, when effective, benefits every bracket of an industry as well as the consumer. It prevents destructive price competition which eventually ends in the failure of a number of retailers with consequent loss to manufacturers and possible failures among this group as well.

"As far as the consumer is concerned, a series of failures of this type will first of all decrease the number of available jobs. Secondly, in order to meet the pressure of retailers who are fighting a price war, manufacturers may decrease the quality of their products in order to reduce prices, and again the consumer suffers.

"As far as the photographic field is concerned, Fair Trade is not yet fully effective. However, one of the most noteworthy gains in the photographic industry, made possible by Fair Trade, is the elimination of retail advertising

NEW PRECISION ELECTRONICS SIGNAL TRACERS



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PRECISION ELECTRONICS, Inc.
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SIGNAL TRACER SPECIALISTS

HIWAY COMPANY

JACKPOT SPECIALS OF OCTOBER!

TUBE OF THE MONTH—829
Brand new. Boxed. Ea. **$2.75**
Order 4 for $10.00 and we prepay shipping.

TCS EQUIPMENT—Eye 'em! Buy 'em!
TCS TRANSMITTER $65.00
TCS RECEIVER 65.00
TCS 12 VDC POWER SUPPLY 21.00
TCS 110 VDC POWER SUPPLY 47.50
TCS REMOTE CONTROL. NEW 14.50
CABLES FOR ABOVE EQUIPMENT:
20 FT. LENGTH 3.50
18 IN. LENGTH 1.75

NOTE: All of above equipment (except Remote Control) is used, in good condition guaranteed. All units pre-tested to assure perfect operating condition.

SCR-274N, ARC-5, ATA/ARA EQUIPMENT
.19-55 Mcs. Receiver. New $14.75
3-6 Mcs. Receiver. Good cond. guar. ... 4.95
6-9 Mcs. Receiver. Good cond. guar. ... 5.95
7-9 Mcs. Arc-5 Trans. New but not factory packed 9.95
(average wt. of above items 13 lbs.)

The Hottest Buy in the Book!
ANTENNA LOADING COIL
Used with GP-6 equipment. Brand new! A buy in just for parts alone! Has coil form which is 6 in. long, 2½ in. diam., heavy, 4-position porcelain tap switch, 2 feed-thru insulators, all housed in aluminum case 6 in. x 6½ in. x 4 in.
$1.49 ea. POST PAID

The Hiway Policy: **25% DEPOSIT WITH ORDER.** Remit in full—**SAVE C.O.D. CHARGES. SATISFACTION GUARANTEED OR YOUR MONEY BACK!**

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Electronic Division
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LOS ANGELES 6, CALIFORNIA
Send for FREE Catalogue!

which contains cut prices on new merchandise.

"In addition, may I point out that in a recent survey conducted by *National Photo Dealer* magazine, 53 per-cent of photographic dealers replying stated that Fair Trade was working in their areas, 26 per-cent indicated that it was partially successful, and only 21 per-cent mentioned that it was not successful.

"The two principal reasons for the failure of Fair Trade wherever it is not working are the inability of the dealers to co-operate to make it work and the indifference of manufacturers towards enforcing their Fair Trade contracts.

"The fight for more effective Fair Trade is still being carried on in the photographic industry and we are looking forward to achieving our goal in the not-too-distant future."

The Problems of Enforcement

Naturally, the application of Fair Trade laws presents problems—some of them quite serious. But, none of them are so great that they could not be solved by the same genius for organization and planning that has brought us the modern television receiver.

A most important problem, as mentioned by Mr. Wolfman, is that of enforcement. Fair Trade laws in themselves impose no penalty. They are, in the terms of the lawyer, "permissible" rather than "mandatory" laws. They permit the manufacturer or vendor to establish Fair Trade prices, but they are only effective *if* someone enforces them. It has been definitely and repeatedly proven that where Fair Trade laws are properly and consistently enforced, uncontrolled and unwarranted price cutting is reduced to a minimum and cut-price advertising is eliminated. Therefore, where such enforcement is lax or entirely lacking, the resulting failure cannot be charged to Fair Trade laws but rather to the failure to enforce them.

Actually, when an article is Fair Traded, *anyone* who is injured by the price cutting may obtain the necessary injunction to cause the offending party to cease. However, because of the legal complications and the expense involved, it is hardly practical for a single dealer to undertake such enforcement, and it is generally done by the manufacturer or a distributor.

For example, in the case already cited in Chicago, it is the distributor who initiates the enforcement, though it must be admitted, since his is the only line in that area that is Fair Traded, it is in some ways a thankless task.

On the other hand, many of the photographic dealers in the Chicago area have organized themselves into the *Chicago Area Photographic Retailers Association* under the leadership of Mr. Harry Graw, President of the *General Camera Company*.

Since most of the items sold in photographic stores are Fair Traded, the

A RELIABLE SOURCE OF 6-VOLT DC

STANCOR MODEL 752 Power Pack

Ideal for...

Servicing auto radios . . . demonstrating auto accessories . . . replacing storage batteries . . . testing push-button solenoids . . . testing 6-volt battery-type radios . . . electroplating and many other uses.

The Stancor Model 752 Power Pack is an efficient selenium rectifier type of power supply—indispensable for many uses around the modern service shop where a dependable source of 6-volt DC is required.

Low internal resistance provides high current capability with good voltage regulation, while heavy duty components are designed to withstand high over-loads. For demonstrating or testing auto radios, several sets with motor tuning can be operated simultaneously.

The Stancor Model 752 Pack plugs into the standard 115-volt, 50-60 cycle AC supply to provide a continuous output of 6-volts at 12.5 amperes DC, or 25.0 amperes intermittently. A built-in voltmeter permits visual checking of output voltage, and a seven-position switch provides variation of output voltages over a convenient range for various loads.

ONLY $43.90

SEE THE STANCOR MODEL 752 POWER PACK AT YOUR DISTRIBUTOR TODAY

Write or ask your Stancor distributor for the new Stancor catalog, listing complete specifications and prices of more than 400 Stancor transformers, chokes and related components for radio and television servicing.

STANDARD TRANSFORMER CORPORATION
ELSTON, KEDZIE & ADDISON • CHICAGO 18, ILLINOIS

drastic price reductions in the GOODELL LINE

These savings are possible as a result of our new policy of selling from factory direct to you.

		Old Price	New Price
AB-3	Power Amplifier	$159.00	$112.00
ATB-3	Power Amplifier	168.00	119.00
C-500	Phonograph Preamplifier	12.50	9.90
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DR-2	Duplex Arm. (Auto. Switch)	65.70	44.00
N-7	Magnetic Noiseraser	57.60	49.50
N-14	Magnetic Noiseraser	97.50	86.75
NSA-20	Noise Suppression Ampl.	154.50	97.50
NSF-1	Noise Suppression Filter	36.00	24.00
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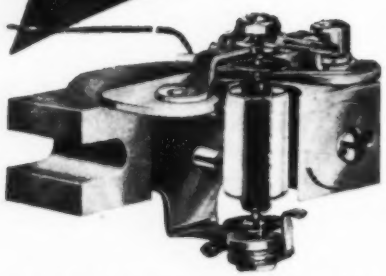
SOFT IRON POLE PIECES

WHY BURLINGTON PANEL INSTRUMENTS PROVIDE UTMOST RELIABILITY . . .



Precision machined soft iron pole pieces and alnico magnets, used by Burlington have no equal for permanent magnetic strength and uniform flux distribution. All ranges AC and DC available in rectangular or round case styles and are guaranteed for one year against defects in workmanship or materials. Refer inquiries to Dept. K-99.

Burlington INSTRUMENT COMPANY
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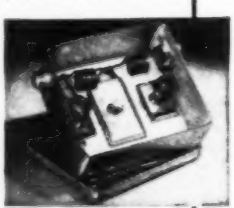
SUPPRESS TVI
with Drake Filters.

Drake TV-300-50HP High Pass TV RECEIVER FILTER
Amateur Net **$3.57**
Add 25¢ for postage anywhere in U.S.A.

Provides high attenuation at all low frequencies — more than 60 db down at the TV I.F. frequencies. This receiver filter will improve TV reception to a remarkable degree by rejecting low frequency interference (below 50 mc.) from amateur and short-wave broadcast, diathermy, QRN and other noise. This small filter with attached ground strap may be easily installed near the TV Tuner for best possible results. Will not reduce the strength of the TV signal.



Drake TV-52-40LP Low Pass TRANSMITTER FILTER
Amateur, Net
$12.95
Add 40¢ for postage anywhere in U.S.A.

Inserted in 52-ohm coax transmission line or coax link between transmitter and antenna coupler, this filter provides excellent attenuation of all antenna and feed system harmonic radiation above 30 mc. with no reduction in signal strength in the ham bands, 10 meters or below. Handles 1 KW on reasonably flat lines. No adjustment required when you QSY or move from band to band.

SREPCO Inc.
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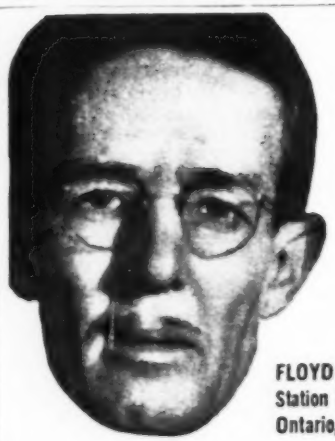
135 E. Second St. DAYTON 2, OHIO Tel. Fulton 2174

TERMS: Cash with order, or 25% deposit, balance C.O.D.



FLOYD HALL
Station KOCS
Ontario, Calif.

"Out-performs all other systems . . ."

GE VARIABLE RELUCTANCE CARTRIDGE

SEE PAGE 27

primary task of this group has been to police their markets and to see that Fair Trade prices are upheld.

To do this they have hired shoppers who periodically check on the prices at which various items are being offered, and when it is established that price cutting has been practiced, preliminary warnings are given; if these are ignored, the matter is turned over to the Association's legal counsel.

A similar plan of procedure has been adopted by the *Guild of Photographic Dealers of New York, Inc.*, and other groups are gradually being formed over the country in an effort to give protection to dealers who wish to carry on a legitimate retail business.

While cases where manufacturers in other fields, have successfully used Fair Trade to control price cutting are too numerous to list here, one of special interest to us in the television field is the recent suit of *Allen B. DuMont Laboratories* to restrain *R. H. Macy and Company* from advertising and selling *DuMont* television receivers at cut prices. Legal action was instituted against *Macy's* after the store ran newspaper ads in New York papers offering *DuMont* sets at 20% off.

At the time of publication of RADIO & TELEVISION NEWS, *Macy's* had been legally restrained from representing themselves as *DuMont* dealers.

DuMont has disfranchised eight or ten dealers for price cutting in the past, but this is the first instance of legal action to protect the manufacturer's price structure.

As previously mentioned, because of the limitations of space, it has been quite impossible to completely present the story of the possible advantages and the problems of Fair Trading as a means of controlling price cutting in the television industry. We have, however, sought to establish the basic principles involved and to illustrate the manner in which it has been successfully applied in other fields.

Naturally, there are many questions that will arise in the minds of our many readers, and we refer them to two sources from which they may obtain additional, accurate information on the matter. They are: *The American Fair Trade Council, Inc.*, at 11 E. 44th Street, New York 17, N. Y. and the *Bureau of Education on Fair Trade* at 205 East 42nd Street, Suite 1909, New York 17, N. Y.

In closing, we feel we can do no better than quote a special message to RADIO & TELEVISION NEWS readers from Mr. Don White, Executive Secretary of the National Association of Visual Education Dealers whose group has the benefit of many years of experience with the problems of price control.

"The best way I know to explain the effect of Fair Trade on the audio-visual business is to compare it to the Bible. That is, not everyone abides by the rules it sets up, but we'd be in a dickens of a fix if we didn't have it at all.

"Most of the products in the audio-visual field are now covered by Fair Trade contracts. Our experience with these has been that *when properly enforced*, they serve to protect the manufacturer, the dealer, and the customer.

"The manufacturer is protected against the loss of his good name, which occurs when his product is price-cut. The dealer is protected against cut-throat competition and can afford to get out and develop sales, confident that he will not lose them to price-cutters. And the customer is protected because he knows he is buying the Fair Traded product at the lowest price at which it can be sold by any reputable dealer. He is relieved of the necessity of 'shopping' for a better price.

"In these days of competition for every consumer dollar, each industry needs to build up, at the dealer level, a hard-hitting and effective sales force—not just order takers, but a sales force that can create the desire to buy.

"The only way such a sales force can be maintained is through protection against price-cutting. And a solidly enforced Fair Trade contract is the only sound means of providing that protection." —30—

EMPIRE STATE GROUP TO GIVE TV COURSE

ESFETA, the Empire State Federation of Electronic Technicians Association, launches a New York state-wide television course to continue through the Fall and Spring of 1949-50.

There will be a total of 16 meetings in the series, each to be presented in four major areas: New York City, Poughkeepsie, Binghamton-Endicott, and Rochester. The lectures in New York City will be held on each first and third Wednesday, beginning with the first week in September. The lectures in Poughkeepsie will be held on each second and fourth Wednesday, beginning with the second week of September. The Binghamton-Endicott lectures will be held on the first and third Wednesdays of each month, beginning with the third week of September. The Rochester meetings will be held each second and fourth Tuesday, beginning with the fourth week of September. These lectures will continue at each of the above locations until all 16 are completed, skipping only the Christmas and New Year's week.

Among the companies sponsoring the courses will be *John F. Rider, Publisher, Ward Products Co., Philco, Westinghouse Electric, Emerson Radio and Phonograph Corp., Allen B. Du Mont, Bendix, Motorola, Hickok Electrical Instrument Co., Radio Service Dealer, RCA*, and *General Electric*.

Additional information, including a complete list of the topics to be covered, is available from Samuel L. Marshall, Educational Director of ESFETA, 262 Sullivan Place, Brooklyn, N. Y. Everyone is welcome to attend any of these lectures. Should you care to participate, please advise the educational director beforehand at the above address. —30—

NOW . . . THE FAMOUS #630 TYPE TELEVISION CHASSIS

THAT HAS SET A STANDARD FOR THE TELEVISION INDUSTRY

OFFERED TO YOU IN A 16 INCH CHASSIS

Not in kit form, completely wired and ready to operate

A COMPLETE TELEVISION CHASSIS

Ready for Custom Built Installation

LICENSED BY RCA

- Built-in voltage doubler
- 31 RCA tubes incl. rectifiers
- RCA 13-channel tuner
- 16" brackets included
- Automatic picture stabilizer
- Long-range fringe reception
- New improved daylight viewing
- Dimensions W-21½" H-10" D-16"

NO FINER RECEIVER AT ANY PRICE

Your Net Price Complete as Pictured (Less CR Tube) $179.45

16" RCA #16AP4 (Metal).....$54.25

16" TEL-O-TUBE #16CP4 (Glass).....$57.50

BEAUTIFUL TV CABINET

Fits any 630 type chassis In Genuine Mahogany or Walnut. Incl. Safety Glass & supports. W—23¾", H—24", D—24½". Special $47.50

ALL CHANNEL ANTENNA

Covers all TV & FM channels. Tuned impedance for line matching. Assembles in a jiffy. 10 ft. upright. List price, $14.75. Yours for.. $7.37

G.I. 3 SPEED CHANGER

Plays all 33⅓, 45 & 78 RPM records. Simple, streamlined. Combine with your radio or TV set. Complete ready to operate. $23.49

INDOOR TV ANTENNA

Instantaneous adjustment, chrome telescoping dipoles. Excellent performance. 300 ohm lead-in included. Regular price $6.95. Special at..... $3.89

TWIN TRANSMISSION WIRE

(300 Ohms)

100 foot hank.....	$ 1.39
500 foot spool.....	6.45
1000 feet	11.95

COAXIAL CABLE #RG59U

(72 Ohms)

100 foot hank.	$ 4.68
500 foot spool.	21.95
1000 feet	39.85

HIGH VOLTAGE FLYBACK

Horizontal Output Transformer

Similar to RCA No. 211-T5. Ample stepped up voltage to convert your 10" receiver to a 16 inch set. Only $4.89

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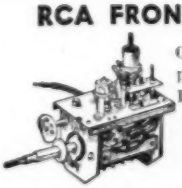

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Distributors' Division
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Tune Your Antenna

(Continued from page 47)

leys on the center mast, where it will separate by itself. Next, tie another strong, paraffin-soaked cord securely to the feeder. (Tape should be used here to prevent the cord cutting into the insulation.) It should be tied to the feeder about 20 feet below the pulleys on the center mast. The exact location where it is tied on the feeder may have to be changed later to suit your particular set-up.

If the cord begins to get too near the pulleys when making initial adjustments, it should be tied lower down. Fasten it securely to some firm support, preferably inside the shack. It should extend straight down from the pulleys to avoid any side pull on the center mast. Running the cord through a pulley near the base of the mast would accomplish this. Fastening the bottom end keeps the feeder from being drawn further than desired through the pulleys.

Weights are now attached to the cords by the masts at the ends of the antenna; use a step ladder to tie them up about 10 feet or more from the ground. These weights should be heavy enough to keep the antenna from sagging, but not so heavy that they will interfere with the proper working of the mechanism. Window weights are ideal, as their slender shape gives them a neater appearance.

Next step is to connect the bottom end of the feeder to the transmitter tank link. Set the transmitter frequency near the low end of the 80-meter band. Untie the bottom end of the cord that is fastened to the feeder, and, with the transmitter on, slowly let it out while you keep an eye on the plate current to the final. As the weights now pull the antenna, making it longer and pulling the feeder up through the pulleys, separating it there to form the antenna, the plate current will rise excessively at one point, indicating maximum load. This will be the maximum length of the antenna on this particular band. Tie the cord securely again.

Allow several more feet of feeder before cutting off the surplus length and connecting it permanently to the transmitter, since the harmonic on 20 meters will require a longer antenna wire to load to resonance.

If, in this process, the weights have reached the ground, they will, of course, have to be tied up again, preferably about 10 feet from the ground.

Tune the transmitter near the high end of the 75-meter band. While it is on, pull the cord, drawing the weights up and shortening the antenna until it loads to maximum again. This will be the shortest position. For convenience in tuning, the cord could be wrapped around a ½-inch shaft, with a crank attached to it.

When the antenna is shortened, it

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may be drawn back through the pulleys in the center and become part of the feeder. This section that is pulled back through the pulleys has been separated, but if the grooves in the pulleys are not cut too deep, the wires will come down practically together because of the tension on them.

Loading on the third harmonic, 20 meters, now becomes an easy matter. The lower end of the 20-meter band should load with the antenna slightly longer than it was when loading on the low end of 80.

Now there will be no more need to say, "Well, OM, I usually work on this frequency because my antenna seems to load up better here than anywhere else." For you have now constructed an antenna without any of the "cut and try" methods and will always be ready to load it to any frequency in the band by a mere "pull of the string!"

—30—

Self-Supporting Towers
(*Continued from page 57*)

and the tower trued up, go over the welds and fill in all open spaces between the various parts. Use plenty of brass to make good joints. This is important, as a poor joint will break loose in a high wind. Test the finished tower by standing it up in the yard and having two men climb it before it is put up on the roof. When installing the tower on the roof, carry it up with the feet bolted in place, but without the antenna array, so that you may mark the location of the holes where the feet are to be bolted to the roof. Use long bolts and pieces of 2 x 4 lumber inside the attic, if this is at all possible, in preference to lag screws which may easily pull out of roof sheeting boards.

After the feet are bolted to the roof, two of the tower legs may be unfastened and the entire assembly tipped over on its side. The antenna array may be installed now while the tower is in this horizontal position and easily accessible.

Weld stand-off insulators to the tower to carry the twin-line or coax cable used for lead-in, but do not tape the lead-in line to the metal tower. Run a #4 wire from the base of the tower to a ground stake for lightning protection, using a stake or piece of pipe at least 6' long for the ground, which is very important and should not be overlooked.

The upper part of the twenty-foot section is the same as the ten-foot section shown in the photograph. No dimensions are given for the cross braces (see the drawing) because these pieces should be cut to fit after the rest of the pieces are welded in place. There will be some variation in the length of these pieces, owing to normal errors that will be made in working with the longer lengths of tubing. For the sake of clarity some of the diagonal bracing has been omitted

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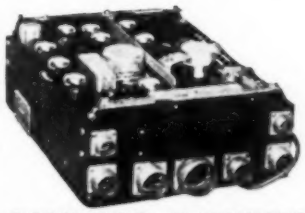

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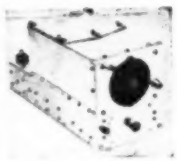

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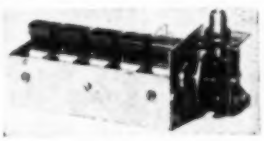

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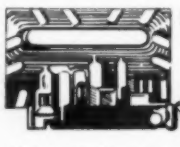

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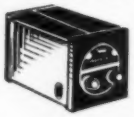

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from the drawing, but it is shown in the photographs.

Thinwall conduit, either 1" or 1¼", makes a good mast for supporting an array above the tower, as it is light, strong, and cheap. Weld a pipe fitting to one end to attach the antenna, or make a simple clamp for this purpose. Some arrays will be supplied with a short stub mast which can be fitted to the tower, but about one ten-foot length is as much mast as should ever be used above the tower; otherwise there will be too much swaying around in the wind.

It is unnecessary to get up more than ten feet above surrounding objects to get a good signal. Going up higher than this will seldom effect a noticeable improvement in signal strength. A good rule to follow in raising the array is to keep the antenna as low as possible, and still have it above objects in the immediate vicinity. Keep the lead-in as short as possible; loss in a long lead-in improperly placed near water pipes or other metal objects often defeats any advantage of a high antenna.

Since most arrays are highly directional, some method of rotation must be provided for when the tower is built. Use a motor if at all possible and a direction indicator, if this is convenient. If there is no provision for turning the array, reception will be confined to one station or to stations located in one particular direction. For reception from one station only, however, it is satisfactory to position the array and fasten it permanently in place. Use an array cut to favor the weakest station you plan to receive, and remember that best results will be achieved with an array cut for one particular channel, rather than for the middle of the band.

—30—

PICTURE POSITIONING WITHOUT CONTROLS

By MATTHEW MANDL

MANY television receivers do not have positioning controls but rely on *focus coil adjustment* for proper picture centering within the cabinet mask. Technicians unfamiliar with this fact normally assume the sole function of the focus coil is to improve picture sharpness and are therefore at a loss regarding positioning of the picture in the absence of specific controls for this purpose.

While it is true that the primary purpose for the focus coil is to bring the picture into sharp focus, the latter is accomplished by manipulation of the focus control, which in turn varies the current through the focus coil so that the change in magnetic field will influence the electron beam. A change in position of the coil, however, will move the picture around on the face of the tube because it changes the beam angle.

Two common types of focus coil mountings are used as shown in the illustrations. In Fig. 2 three thumb screws are provided so that the tilt of the focus coil can be adjusted either horizontally or vertically. Adjustments are facilitated if the thumb screws are not loosened too much, because retightening after the proper positioning has been found may mean a change in coil tilt. A mirror placed in front of the picture tube will permit observation of changes as the coil is undergoing adjustment.

In Fig. 1 adjustments to the focus coil are made by the four bolts at each corner of the mounting frame. The set-screws extend through four springs which keep the focus coil assembly rigid during and after adjustment. Each set-screw should be turned a few times in succession, and meanwhile watch its effect on picture positioning on the screen. If proper positioning requires excessive loosening of one or two screws, *all* should be tightened and the procedure started over. Readjust the ion trap magnet unit, for the focus coil change will have some effect on ion trap placement for maximum brilliancy. Finally, the focus control should be set for clearest picture.

Focus coil adjustments will swing the picture in every direction, but will not correct a tilt. If the picture is tilted downward at either side, the yoke assembly must be loosened and swung around slightly until the picture is level. On seven-inch tubes using electrostatic deflection, picture slant is corrected by a slight rotation of the picture tube itself.

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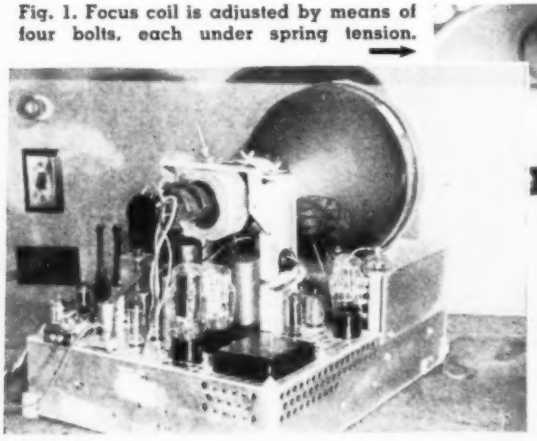

Fig. 1. Focus coil is adjusted by means of four bolts, each under spring tension.

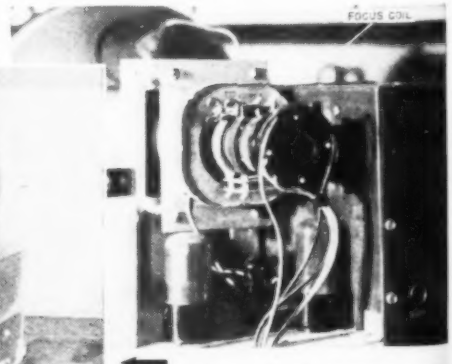

Fig. 2. Three thumb screws are provided for vertical or horizontal adjustment of focus coils.

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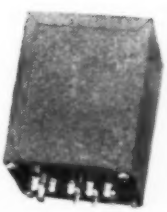

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Modern TV Receivers

(*Continued from page* 60)

electrostatic deflection systems to vertical electromagnetic deflection systems was simply made, this is not true in the case of horizontal systems. The reasons for this are twofold. First, the retrace time for the horizontal deflection voltage is only seven microseconds long. To accomplish retrace in so short a period requires a relatively high voltage which, in turn, means the use of low-loss components. The tendency for the circuit to oscillate beyond the seven-microsecond period is, consequently, quite marked, and special damping elements must be provided. Second, the large amount of energy that is developed during this horizontal retrace interval has been utilized in many sets to provide the high accelerating voltage required by the cathode-ray tube. This is done by connecting a high-voltage rectifier across the primary of the horizontal output transformer. This method of developing the high voltage is stable, simple in operation, and economical. It is known as the fly-back method and is one of the two methods currently employed in practically all television receivers. The other method utilizes a separate oscillator to develop the high voltage and will be discussed in a subsequent article.

A diagram of the horizontal sweep system when adapted to electromagnetic cathode-ray tubes is shown in Fig. 7. The circuit, up to the horizontal output transformer, follows closely the design employed in vertical electromagnetic deflection systems. Beyond this point the circuit changes, containing a diode damping tube in addition to the horizontal deflection coils. In order to properly interpret the action which occurs in this circuit, the following relationships within the horizontal scanning interval must be known. A complete horizontal scanning cycle is 1/15,750 of a second, or approximately sixty-four microseconds. Of this, the visible portion of the horizontal trace is about fifty-three microseconds long. The blanking interval, then, is eleven microseconds long, and during this time the beam must be returned to the left side of the tube and the forward trace started and made linear. If all this is to be accomplished within eleven microseconds, only seven microseconds can be allotted to the return trace.

During the fifty-three-microsecond trace period, the voltage across the deflection coils is positive and constant, as shown in Fig. 8C. This will produce a linearly rising saw-tooth current in the coils. In addition, there is a small saw-tooth voltage which compensates for the resistance in the circuit. This state of conditions continues until the beam has been deflected across the screen. At this moment, the voltage at the grid of the output tube drops sharply (Point A, Fig. 8A) and the plate current of the 6BG6

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SEE PAGE 27

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driving tube will be suddenly cut off.

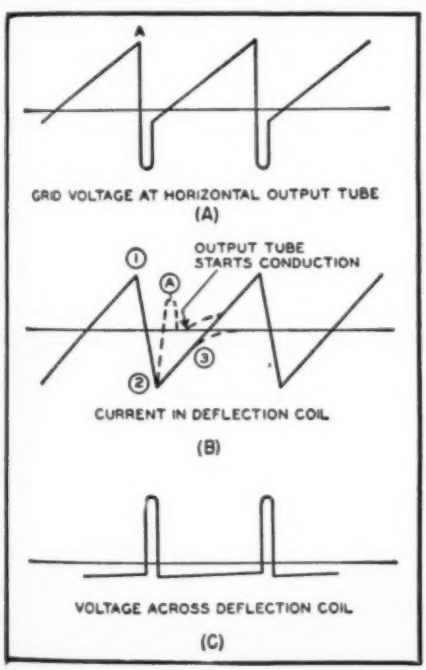
The magnetic field, which has been building up in the output transformer, collapses. The rate of collapse is determined by the natural resonant frequency of the system, and this is designed to be 75 kc. in order to insure a sufficiently short retrace period.

Note that the system is shocked into oscillation by this sudden cut-off of plate current. The voltage generated by the collapsing field is negative on the plate of the damping tube preventing this tube from conducting. Thus, there is actually no load across the transformer, and the system, if left in this condition, would oscillate vigorously. This is actually done for one half-cycle. At the end of the first half-cycle the deflection coil current reaches a maximum value in the reverse direction to which it was flowing at the end of the trace period. The induced deflection voltage now reverses polarity and the damping tube begins to conduct. By now, beam retrace has been completed, and the next trace must be started.

The energy which was developed in the coil by the output tube when it was cut-off is still largely present. Very little energy was lost during the first half-cycle of retrace, because the damping tube was non-conductive, and the circuit loss was low. When, after the first half-cycle, the damping tube does begin to conduct, it places such a heavy load across the deflection coil that further oscillations are prevented. The magnetic field begins to decay at a rate determined by the load of the damping tube across the coil.

Before we proceed further, let us stop and note carefully the sequence of events. When the negative portion of the deflecting voltage drives the grid of the output tube to zero, the deflecting yoke, output transformer,

Fig. 8. Voltage and current waveforms in the horizontal output circuit of Fig. 7.



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45c Each
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20x20 Mfd. @ 450V	.47
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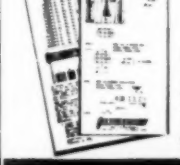

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and other incidental components form a resonant circuit which is shocked into oscillation. The time of a half cycle of this oscillation (75 kc.) is about seven microseconds, and the retrace occurs within its allotted time. At the end of a half-cycle, the damping tube begins to conduct, causing the oscillatory voltage to decay in essentially a linear manner. Note, however, that very shortly after this the output tube starts to conduct again and this additional current, in conjunction with the decay current in the deflection coil, produces a linear trace motion of the electron beam.

The waveforms in Fig. 8 illustrate graphically the action within the circuit. Fig. 8A shows the voltage applied to the grid of the horizontal output tube. In Fig. 8B we have the current in the deflection coil, as indicated by the heavy solid lines. At Point (1), the tube is driven into cut-off and the magnetic field collapses and reverses itself. At Point (2) the retrace interval has ended, although the cathode-ray tube is still blanked out. The dotted curve *A* shows what would occur if the damping tube did not begin to conduct and prevent the oscillations from continuing. From Point (2) to Point (3) the energy remaining in the deflection yoke is decaying in a fairly linear manner. At Point (3), this energy has begun to die off, and at this moment the output tube starts once again to conduct. The resulting interaction of these two currents is a linear rise in current. This sequence of events is repeated each cycle.

The damping tube serves not only to prevent continued oscillations in the deflection coils after retrace, but also to convert some of this energy to a useful d.c. voltage. At the time the horizontal output tube is brought into cut-off, a tremendous amount of energy is in the output transformer. Part of this energy is used to bring the electron beam from the right-hand side of the screen to the left-hand side. When this has been accomplished, a considerable amount of energy remains, which would result in continued oscillations if the damping diode were not present. As it is, the diode begins to conduct at this moment, not only preventing the continuance of the oscillations, but also rectifying the pulse into d.c. This rectified voltage appears across condensers C_1 and C_2. These condensers become charged from the "B +" supply voltage, as well as from the resonant voltage produced during the retrace interval. This added voltage amounts to about 75 volts. As can be seen from the connection of the cathode of the damping tube to the junction of L_1, C_1, and C_2, this additional 75 volts acts in series with the d.c. plate voltage, thereby increasing the effective d.c. voltage on the output amplifier. Thus, in the circuit of Fig. 7, the 270 volts from the power supply is increased to 345 volts.

The voltage across C_1 and C_2 varies due to the charging by the deflection

coil kickback and the discharging through the output tube. The rise and fall of this voltage is equivalent to an a.c. ripple in the "B +" supply reaching the horizontal output tube. L_3, C_1, and C_2 form a phase-shifting network and by shifting the phase of this ripple, it is possible to alter the tube's characteristics. L_3 is variable and can provide small improvements in linearity. Adjustments of the inductance of L_3 causes the second quarter of the picture to stretch and the first quarter to crowd.

An additional control in this circuit includes L_2 (width control). L_2 is shunted across the secondary winding of the horizontal output transformer and can vary the output of this transformer and hence the picture width. Except when the set is first turned on, the damping diode conducts only during the retrace interval. At all other times it is kept cut off by the voltage existing across C_1.

(To be continued)

A Signal Tracer

(Continued from page 51)

the use of the signal tracer for checking a.c.-d.c. receivers is to connect the ground clip of the signal tracer to one side of the power line. When the ground clip of the tracer is connected to the floating ground of an a.c.-d.c. receiver, the signal tracer will pick up 60 cycle a.c. hum. Connecting the ground clip of the signal tracer to the power line will remove this difficulty.

As an added suggestion, in checking a.c.-d.c. receivers, an idea that has proven very satisfactory is to connect an isolation transformer between the power line and the receiver. This is merely a transformer with a 120 volt primary and a 120 volt secondary. These transformers come equipped with a cord and plug on one winding, and a socket on the other. Using this transformer removes the power line ground from the receiver under test and simplifies all testing on the receiver.

—30—

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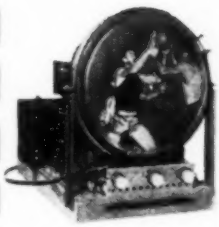

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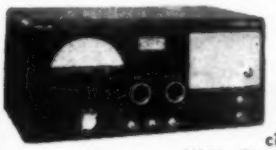

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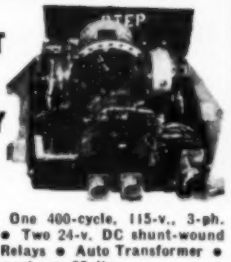

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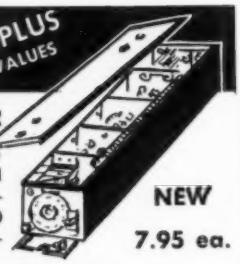

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Beginning Amateur

(*Continued from page 43*)

accusation. It is unfortunate that this tiny but garrulous minority exists at all, and that there is no treatment for these "phone-phonies" other than ostracism.

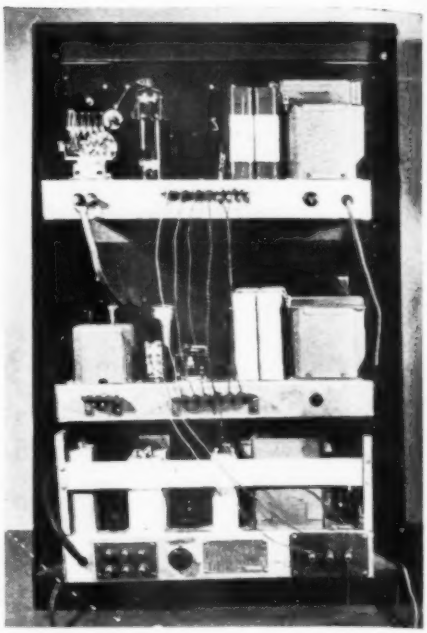
Many otherwise sane and sober citizens appear to go berserk when they wrap their fingers around a mike stand. The ham ticket is a license to operate a private radio station for point-to-point communication, and is not official permission from Uncle Sam to make a fool of one's self in public. What's the point in telling the other guy that you received his last transmission okay, and then repeating back to him every word he said; or of giving a poor imitation of Arthur Godfrey; or of using the regal "we" when you're referring only to one person, yourself; or of giving your life history without being asked for it? Be natural, and be human. You'll make more friends that way, on the air and off.

Keeping your location and identity a "secret" from the neighbors is well nigh impossible. You have to give your call letters, and from then on, tracking you down is easy. What fun will you get out of one of the grandest hobbies in the world if you have to act almost as a fugitive?

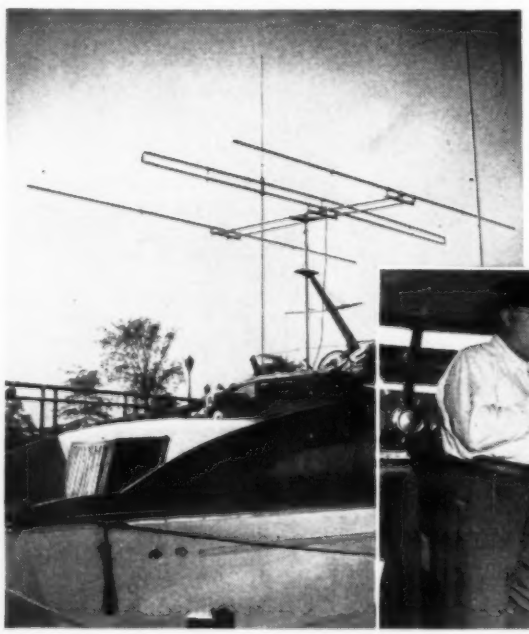
History is only repeating itself. During the early days of sound broadcasting, "amateurs" were blamed for every rumble of static, every bit of noise produced by sparking elevator switches, diathermy machines, etc. Sure, they did contribute a little to the QRM, but as broadcast receivers improved in performance and transmitter technique forged ahead with new tubes and new circuits, the complaints quickly fell off almost to zero.

It is no secret that many expensive TV receivers have perfectly "lousy" r.f. systems and are, therefore, highly susceptible to interference from close-by ham transmitters; but it is also no secret that hams are just beginning to understand the necessity for harmonic suppression, r.f. shielding, etc., in their rigs. Keep working on your transmitter to minimize its unwanted emissions, and talk on the air as you would over the telephone, in a calm, sensible fashion. If a neighbor hears you carrying on an interesting conversation with another ham in Africa or Japan, he's likely to become interested himself, and maybe he'll ask to see your station instead of suggesting heatedly that you blow it up.

One of the most rabid hams I have encountered in years is a retired fireman, who before he was bitten by the



How the r.f. and modulator sections are mounted in the top portion of a three-foot rack, with a receiver in the bottom layer. All interconnecting leads, fuses, etc., are at the back of the chassis, convenient for changing and experimentation.



Myron Zobel, W2NMC, aboard the yacht "Norte." With a fixed 10-meter, three-element beam overhead, he has worked all over the world. Equipment is Hallicrafters' HT-18 exciter, HT-9 transmitter, and SX-42 receiver. The three-element beam antenna on the "Norte" excites attention wherever the boat goes. The vertical antennas are for operation on the lower frequencies.

bug, lived just over a 20-meter phone man in a New York apartment house. The guy used to spend all his time next to a radio receiver, so it didn't make any difference when the phone man operated; he was sure to QRM him. One day, the ham had the inspiration to invite the complainer in to listen to a "real receiver," his pet HRO, the implication being that there wouldn't be any interference on a good set. Conditions were "hot," and the HRO dragged in signals from everywhere: hams, ship-to-shore, foreign broadcasting, etc. The fireman stayed on far into the night, worked a couple of South Americans himself (he knew a little Spanish), and left with the ham's copy of the Handbook. Within three months, the fireman was on the air with a 100-watt rig of his own on 10-meters and on the receiving end, this time, of complaints from housewives who couldn't hear their soap operas! He moved to a place in the country, put up a veritable forest of antennas, and is so busy building and rebuilding that he has completely forgotten about his arthritis, gastritis, and other imaginary afflictions!

(To be continued)

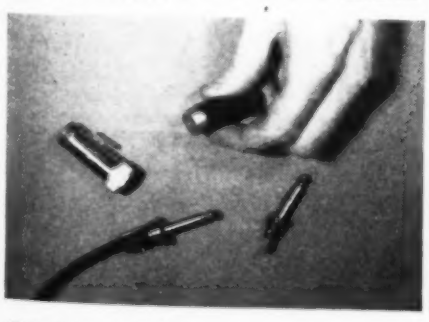
MICROPHONE CONNECTOR-ADAPTER

ANYONE who has worked much with sound and p.a. equipment has at some time or another come face to face with the problem of tying together microphone and phonograph lines with different kinds of plug-and-jack arrangements.

Commercial radio companies, hams, and other specialized groups usually employ the "phone plug and spring jack" type of connector, while most open-market public address and phonograph equipment is provided with so-called "cable connectors," fastened together by screw threads.

A partial, but very effective, solution to this dilemma is shown in the photograph. A chassis-type male "cable connector" is mounted in the back of the bakelite shell provided with a standard phone plug. (If shielding is important, a nickel-plated brass shell should be used, of course.) The connector and the phone plug are properly wired together with short loops of solid hook-up wire, and the unit screwed together.

Several of these handy adapters will meet almost any situation. Thus a "cable-connector"—equipped microphone can instantly be transferred from a like-equipped p.a. amplifier tube to a conventional "plug-and-jack" amateur transmitter, simply by the insertion of the adapter "gimmick" between the transmitter jack and the mike connector. . . . . H.C.A.



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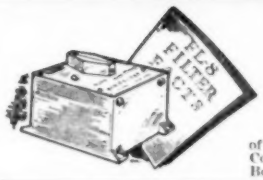

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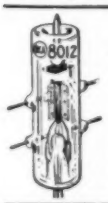

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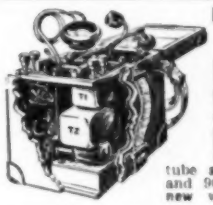

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A hermetically sealed unit, conservatively rated at 10 henries @ 200 ma. Has hum-bucking tap. Steel cases—ONLY $1.98 each.

HANDSET HANGER

Accommodates all makes and models (W-E, Kellogg, American, etc.), handsets such as TS-9, 11, 13, etc. Fastens to side of desk or on telephone equipment. Felt facing protects handset. Black crackle finish only .....$1.95 each.

TS-10 SOUND POWERED HANDSETS

ALL brand-new! Made by W-E, RCA and Automatic Electric. Requires no batteries or transformers! Useful for TV antenna installations inter-coms, line communication, etc. "No battery" feature provides safe communications in plants where explosive chemicals are used. Air-mail or wire your orders now as supply is very limited. Price $16.95 per pair.
Replacement W-E receiver units for TS-10 handsets $4.95 each.

RM-29A TELEPHONE

Contains magneto ringing system. Uses standard batteries. Only two wire line required. Several units may be paralleled on same line. Ideal for communication, farms, factories, TV work, etc.
One RM-29A telephone with battery and one TS-13 Handset. Brand new. Price $12.95 each.

SENSITIVE, 6500 OHM SP-ST RELAY

Made by Automatic Electric Co. Normally-open, wiping contacts, relay is midget size and very light weight. Closes on 2 ma. Ideal for models and control.
Only $1.25 ea.; 10 for $10.00

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● One of our best sellers! Useful, versatile laboratory item, in kit form. Simple, and easy to build in less than an hour. Checks condenser leakage and continuity up to 8 megs. Will test any paper, electrolytic, mica or oil capacitor from 50-mmfd. to 50-mfd. Self-contained power supply and neon bulb indicator with socket and bezel. Drilled metal cabinet. Complete instructions and diagrams included with each kit. Only $4.85.

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LORD 8 lb. 7c ea., 8 for 45c; $3.00 per C
LORD 10 lb. 15c ea., 8 for 98c, $7.50 per C
HARRIS 8 lb. 8c ea., 8 for 45c, $4.00 per C
HARRIS 12 lb. 16c ea., 8 for $1.05, $9.00 per C.

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Wired Sub-Assembly Chassis

Convert any set—such as RCA 630TS, or other standard TV with Flyback circuit, the Transvision chassis, or other similar kit chassis. TELERAMIC Conversion Kits contain all components, including booklet of simple step-by-step illustrated instructions. The Teleramic sub-assembly chassis is completely wired and ready for installation. You get front and rear mounting brackets plus an insulation ring and sleeve, horizontal output transformer and tube—everything necessary for the complete conversion.

CHOICE OF 3 MODELS

Convert RCA type 630TS chassis to 16" metal tube. Model No. 116R. $24.60
Convert RCA type 630TS chassis to 15" glass tube. Model No. G-116R. $19.80
Convert Transvision chassis to 15" glass tube. Model No. G-116T. $19.80
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Be The Radio Expert Of Your Locality Who Handles The Toughest Service Jobs

This new, 7 volume set gives you solid working knowledge of Radio and Television. Covers everything from fundamentals to newest in FM, Television, Electronics, etc. Clear, practical. Tells you how to construct, install, service. Short-cut trouble shooting methods. Handy "on the job" manual included. More than 2500 pages, 1200 illustrations, charts, diagrams.

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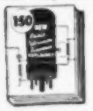

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Fringe Area Reception

(*Continued from page 46*)

terest. One of the difficulties with receiver operation in fringe areas is poor sync-stability. One of the major sources of sync-instability of television receivers in the fringe area today is the a.g.c. system, if a.g.c. is used.

Considerable improvement in sync-stability in fringe areas can be realized by grounding the a.v.c., or by applying a fixed bias. This bias should be such as to allow maximum gain of the receiver without exceeding the tube rating.

Receivers in which the sync clipping level is not affected by the contrast control perform better than receivers whose sync clipping is dependent upon the contrast control setting. If the received picture contains a considerable amount of snow, the best contrast-level setting does not coincide with the proper sync-clipping level.

The a.f.c. type of horizontal sync control is quite important in the fringe area. If triggered-type sync is used, although it can be designed to provide sufficient immunity against interference pulses, the thermal input noise will still cause a slight shift of each horizontal line and thereby decrease the picture resolution.

It is usually vertical-sync stability which suffers first, due to interfering pulses. Two types of vertical oscillators are in general use. One type is the multivibrator, and the second type is the blocking oscillator. The blocking oscillator will not hold sync as tightly as a multivibrator with the sync injected in the first grid. However, the multivibrator is more susceptible to noise pulses than is the blocking oscillator. Unless the sync pulses are very well clipped, a large noise pulse will cause a momentary collapse of the vertical oscillator.

To minimize the susceptibility to noise pulses of the multivibrator, the impedance at the sync-injection grid should be as low as possible and still maintain a positive lock-in with the sync pulses. Some receivers using blocking oscillators show a tendency to roll vertically even though the receiver will lock horizontally and sufficient contrast is available to see the picture. This is due to insufficient sync-amplitude injection and can be corrected only by increasing the gain either in the sync-amplifier chain or by additional preamplification.

The sound section of the receiver should not be overlooked. It is important that it have good discrimination against interfering amplitude pulses.

The intercarrier type sound, although it is generally thought of for use in cheaper receivers, can be made to operate surprisingly well in the fringe areas. In one case, a receiver has been made in which the sound beat was taken off the second detector

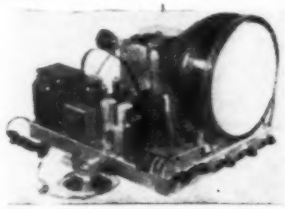
NEW TELEKITS NOW 59.50

Jobbers: Write for Confidential Price Information

NEW TELEKITS
10-B $82.99
7-B $59.50

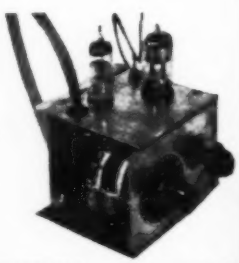
Sparkling new Telekit 10-B has 52-inch screen. Brand new compact lay-out has video tube mounted on chassis. Big illustrated easy-to-follow instruction book guides you step by step through easy assembly. No special knowledge of television is required. All you need is a soldering iron, pliers, and screw driver. 10-B kit can be used with 12½, 15, 16 inch tubes. Telekit 10-B, $82.99. Tube kit, including 10BP4 and all other tubes, $55.80. 10-B Telekit cabinet $15.95 to $24.50. Telekit Guarantee includes free factory service.

Write for catalog listing 10-B and 7-B Telekits. New 7-B Telekit for 7-inch tube, $59.50. Tube kit, including 7JP4, $39.58. 7-B cabinet, $15.95 to $24.50.



Note simple clean lay-out for easy assembly of new Telekit 10-B. Features 2 sound I. F. stages, a new pre-built, pre-aligned tuner that includes a stage of R. F. for distance reception. Easy-to-adjust horizontal lock circuits. Beautiful new model cabinets for 7-B and 10-B are heavily constructed of hand rubbed walnut.

13 CHANNEL TUNER $19.95



NEW 13 CHANNEL TUNER is a small compact unit with stage of R.F. Tunes all TV and 2FM channels. Made to conform with Telekit or any other TV set having video I.F. of 25.75 Mc. Complete with tubes, pre-wired, pre-aligned; only three connections to make. See your jobber, or write to us for information. Your cost, $19.95.

Write for catalog of Telekit antennas, boosters, television kits tuners, television parts and tubes.

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ELECTRO-TECHNICAL INDUSTRIES
1432 NORTH BROAD STREET PHILADELPHIA 21, PA

output. This was followed by two stages of 4.5 mc. amplification and a ratio detector. The ratio detector was followed by a pentode audio amplifier and a 6V6 power-output tube. This receiver would produce reasonably good sound, although the video carrier level was so low as to render the picture unrecognizable.

In cases of very weak signal, it is possible to receive improved pictures by disregarding the proper vestigial side-band characteristic. In other words, although it is proper to set the video carrier at a point 6 db. down the side of the r.f.-i.f. characteristic, if the thermal noise is great enough to limit the picture resolution to approximately 200 lines or less, the picture will improve both in stability and signal-to-noise if the video carrier is set near the top of the r.f.-i.f. characteristic.

If the receiver is aligned in this way, although it will work best on extremely weak signals, when the signal strength is increased, the resolution capabilities of the system will not be realized. In other words, even a noise-free picture would probably have only 275 to 300 lines of resolution, whereas 350 lines should be readily obtainable.

The intercarrier sound system allows the oscillator to be set in such a manner as to produce the best compromise between picture resolution and sound for various input signal-strengths. —30—

LEVER SCREWDRIVER

TO UNFREEZE those stubborn bolts, you need only a simple homemade tool—a converted screwdriver.

Just bend the tool's tip about five or ten degrees, at an inch or so above the end of the shaft. You'll find that this quick alteration affords plenty of extra leverage when you need it to loosen up an extra tight screw.

It wouldn't be wise to bend the bit of an expensive ratchet screwdriver (as the author did, accidentally). Better use an older, or less expensive one!

. . . . . H. C. A.

A lever screwdriver makes a useful tool to loosen rusted bolts on a magnetic speaker.

Our 27th Year

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The Home of RADIO

QUALITY—PRICE DEPENDABILITY

CHOKES

SMOOTHING TYPE	Hy	SWINGING TYPE	Hy	PRICE EACH MA	Price
C-80	10	C-87	4–16	150	$3.09
C-81	10	C-88	4–16	200	$3.82
C-82	10	C-89	4–16	250	$5.39
C-83	8	C-90	3–14	300	$5.39

All above 3000 Volts Insulation

WIRE WOUND POTENTIOMETER
100,000 ohm, precision made G.R. type, 25 watt, 6" diameter. Brand New $1.95

SELSYN MOTORS
115 V.A.C. 60 cycle #C-78348. Can be used to turn small antennas or as indicators. Size 3½" x 5½". Price per pair $6.95

NATIONAL TELEVISION BOOSTER
Live in a fringe area? Want clear bright pictures? Want noises reduced? The new National TV Booster solves your problem. Covers all 12 channels. It's ideal for apartments or other places where outdoor antennas cannot be used. Self contained power supply, 115V AC, 60 cycles, 10W. Special $39.95

PLATE TRANSFORMERS
For Small Transmitters. DC Voltage Ratings are Approx. Values Obtained at Output of a 2 section Choke input Filter. Using Mercury Vapor Rectifier Tubes Pri. is for 115 V. 60 cy

Type No.	Sec. Rms. Volts	Sec. DC Volts	Sec. DC MA.	Dimensions H.	W.	D.	Price Each
P 37	660–660†	500	250	4⅜	3⅛	4⅜	$ 6.76
	550–550	400					
P 58	1080–1080	1000*	125	4⅜	3⅛	5	8.23
	500–500	400	150				
P 39	900–900	750	225	4⅜	3⅛	5⅛	7.94
	800–800	600					
P 67	1450–1450	1200	300	5¾	6⅛	4	19.84
	1175–1175	1000					
P 68	2100–2100	1750	300	5¾	6⅛	4¼	24.99
	1800–1800	1500					

* For dual operation with simultaneous use of both sec ratings. † Has 40-volt bias tap.

FILAMENT TRANSFORMERS

Type 940	2.5VCT @ 10 Amps. 7500V Ins	$2.79
Type 940	5. VCT @ 3 Amps. 2500V Ins	$2.06
Type 941	5 VCT @ 6 Amps. 2500V Ins	$3.38
Type 943	5 VCT @ 20 Amps. 2500V Ins	$5.29
Type 946	6.3VCT @ 3 Amps. 2500V Ins	$1.91
Type 947	6.3VCT @ 6 Amps. 2500V Ins	$2.79
Type 948	6.3VCT @ 10 Amps. 2500V Ins	$3.67
Type 960	7.5VCT @ 4 Amps. 2500V Ins	$2.35
Type 143	7.5VCT @ 8 Amps. 2500V Ins	$4.12
Type 146	10 VCT @ 10 Amps. 3000V Ins	$4.99
Type 961	Dual 6.3VCT @ 3 Amps 2500V Ins	$3.38
Type 041	5VCT @ 3 Amps. 2500V Ins	$3.38
	6.3VCT @ 3.6 Amps.	

NATIONAL TELEVISION chassis

TV-10C Chassis with tubes less picture tube & cabinet —$149.50

TV-10W Same Chassis with 10" tube & handsome genuine mahogany cabinet $269.50

The most versatile television chassis yet designed! Three basic units — power supply chassis, RF chassis and deflection yoke assembly — may be placed side by side, one above the other, etc., to conform to any cabinet. Simply plug in the cable connecters. Each unit is soundly engineered and built to famous National standards of performance.

1. Operates 10" or 12" picture tube. 2. Tunes all 12 channels. 3. Wired, pre-tuned and tested—not a kit. 4. RF stage employs tuned grid and plate for maximum gain and optimum band width. 5. Unique 36 mc IF minimizes interference. 6. Fine tuning control covers range of 2-3 mc. for maximum tuning accuracy. 7. Improved intercarrier sound. 8. Magnetic deflection and "flyback" high voltage supply. 9. 72-ohm unbalanced and 300-ohm balanced inputs. 10. Supplied with two six-inch PM speakers.

SCOPE & TELEVISION TRANSFORMERS & CHOKES

2500V. RMS @ 5 Ma D.C.—6.3V. @ 3 amps tapped at 2.5V. @ 3 amps; 2.5V. @ 2 amps; Type P-3171 $6.76

1700V. RMS @ 2 Ma D.C.—6.3V. @ 9 amps tapped at 2.5V. @ 2 amps; 2.5V. @ 2 amps; Type P-3170 $5.14

2 Hys @ 250 Ma D.C. 50 ohms type C-2991 $1.62

2 Hys @ 200 Ma D.C. 50 ohms type C-2974 $1.92

VERTICAL BLOCKING OSC. turns ratio pri. to sec. 1:4.2
Unshielded type A-3000 $1.18
Shielded type A-4000 1.62

HORIZONTAL BLOCKING OSC. turns ratio pri. to sec. 2:1
Unshielded type A-3002 $1.32
Shielded type A-4002 1.76

VERTICAL OUTPUT turns ratio pri. to sec. 10:1
Unshielded type A-3035 $3.09

ISOLATION TRANSFORMERS
All 117 Volts to 117 Volts 60 Cy.
P-96, 40 watts $3.60 P-98, 100 watts $9.30
P-97, 80 watts $5.10 P-99, 250 watts $17.70

RAYTHEON VOLTAGE STABILIZERS
Positive Stabilization ± ½%
Input 95-130 volts, 60 cycles single phase; output 115 volts stabilized to ± ½%. *Output 6.0 or 7.5 volts stabilized ± ½%.

Catalog No.	Output Cap. Watts	Net wgt. lbs.	Net Price
VR-6110	15	4	$15.00
VR-6101*	30	5	$17.00
VR-6111	30	5	$17.00
VR-6112	60	8	$24.00
VR-6113	120	14	$31.00
VR-6114	250	25	$48.00
VR-6115	500	45	$75.00
VR-6116	1000	92	$125.00

19" Rack Panel Cabinets
Made of 1/16" Steel
Black Crackle Finish

RC-10–10½x21½x15	$ 9.99
RC-14–14x21½x15	12.15
RC-15–15¾x21½x15	13.69
RC-19–19¼x21½x15	16.64
RC-28–28x21½x15	18.80
RC-36–36¾x21½x15	21.55

GRID DIP METER
LYSCO "DIPMASTER"
3 Mc to 150 Mc frequency range; calibrated dial. Ideal for Signal generator, 3.4 to 300 Mc range phase monitor, F.S. meter, or absorption wavemeter. Complete power supply and tubes. Really a good buy at $33.50

TRANSFORMER SPECIAL
870 volt CT @ 250Ma with 80V bias tap
5 volts @ 3 amps
2½ volts CT @ 10 amps
2½ volts @ 2 amps
6.3 volts @ 1.5 amps
115V. 60 cycle primary
$5.88

SUPERIOR POWERSTATS
Smooth, efficient voltage control. 0 to 135V. output from 115V. AC line.
Type 20 (illustrated 3 amps $12.50
116 for table mtg 7.5 amps 23.00
116U for panel mtg 7.5 amps 19.00
1126 15 amps 46.00
1156 45 amps 118.00
Also available for 230 volt input. Write for descriptive literature.

If not rated 25% with order, balance C.O.D. All prices F.O.B. our warehouse New York. No order under $2.00. We ship to any part of the globe.

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TUBE TESTERS
World Famous

MODEL 533P

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SEE YOUR JOBBER OR WRITE FOR COMPLETE INFORMATION TODAY

NEW TV RECEIVERS ----------on the Market

NEW HALLICRAFTER LINE

The Hallicrafters Company, 4401 West Fifth Avenue, Chicago 24, Ill., recently announced prices on the five TV models introduced in the July

market in Chicago. Among the five is the Model 600, a 10-inch tube table model, which retails at $189.95.

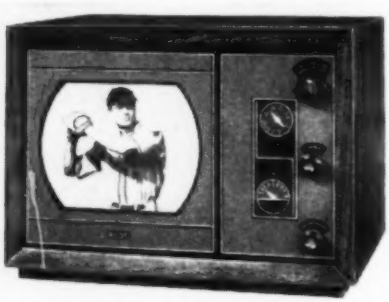
All of the models use the same basic chassis, with a simplified control system of three knobs, one for contrast and brightness simultaneously, another for volume, and the third for channel selection. A fine tuning control is provided in the center of the channel selector knob.

Prices on the new models represent reductions from prices of comparable models in the current line of the company; for example, the 10-inch wood table models were dropped in price from $269.50 to $189.50, and the new sets will have built-in antennas.

Two 12-inch and two 16-inch tube table, console, and consolette styles comprise the remainder of the newly introduced line, ranging in price from $239.95 to $369.95.

"MYSTERY MODEL" DEBUT

Hitherto a carefully guarded secret, details of the Model TV-121 were revealed recently by the *Pilot Radio Corporation*, 37-06 Thirty-Sixth St., Long Island City 1, N. Y., in conjunc-



tion with the announcement of its new merchandising policy which will appoint one exclusive franchised dealer in every TV city in the country. Each dealer will, therefore, be the exclusive purveyor of *Pilot* sets.

Slated to retail for $269.50, Model TV-121 has a 26-tube chassis, offering a full 12½ inch direct-view picture, FM radio, and phono jack for any type of record player. Focus and brightness controls are at the rear of the chassis, but do not require resetting after initial adjustment. "On-Off" and volume, tuning, and contrast controls are on the front. It was further demonstrated that the circuit design of the model offers improved performance in both fringe and metropolitan areas, with only a simple indoor antenna required in most locations.

8½-INCH TV RECEIVER

Offering over 50 per-cent increase in picture size as compared with small-tube receivers in the same price range, a set with an 8½ inch screen, announced by *Motorola, Inc.*, 4545 Augusta Blvd., Chicago 51, Ill., is the first to be produced.

A new circuit development was designed to keep picture brightness stabilized. The viewing tube incorporated in the set is a high-voltage type, exclusive with *Motorola*. Three controls

only are needed for normal operation, with the picture and sound tuning accomplished simultaneously. For its picture size, the new set, priced at $149.95, is light and compact, weighing just 26 pounds.

Some of the other TV receivers in *Motorola's* new 1950 line will now contain a new "Bilt-in-tenna," a double-loop television antenna constructed right into the cabinet. It has been reported that this antenna will permit reception in good signal areas without need of an outside aerial of any kind.

Also featured in *Motorola's* new line is a simplified tuning system, with only the station selector and volume control knobs on the front of the set. All other controls are to be automatic.

DUMONT "RUMSON"

Among the three new television receiver models recently introduced by the *Allen B. DuMont Laboratories, Inc.*, is a 12½ inch table model, called the "Rumson," which has a direct-view picture size of 85 square inches.

All three of the new models feature several electronic special developments for superior fringe area reception and sharper pictures. The "Rumson" has, besides, the *DuMont* square station selector dial with tuning made easier by both fine and coarse adjustments. Size of this 30-tube model, which is provided with full-range FM radio, is 22¾ inches wide, 17½ inches high, and 20 inches deep.

Introduction of these three models, the "Rumson," "Sheffield," and the

"Sussex," marked the fourth new receiver to be added to the line of the Passaic, N. J., firm. The "Bradford," was placed on display just previously.

V.H.F. AND U.H.F. TV

After testing its new television models, *Industrial Television, Inc.*, of Clifton, N. J., announced that it is ready to produce combination v.h.f. and u.h.f. receivers just as soon as the service is inaugurated. It was stated that the *I.T.I.* design covers the present twelve v.h.f. channels and the entire u.h.f. range of 470 to 890 mc. with continuous tuning. Both the proposed FCC commercial channel assignments and the experimental television region are covered to insure against obsolescence.

At present, the company is manufacturing a converter to allow use of the present v.h.f. receivers in the u.h.f., so that present owners of its receivers will not suffer from the changeover.

On the question of cost, it was quoted that the new all-band receiver would be one-quarter more expensive, due to increased production expenses, than a comparable v.h.f. set, although it was not necessary to make them larger than conventional v.h.f. receivers.

ZENITH "ST. REGIS"

One of the features of the new *Zenith* console is a picture control switch which allows a choice of either the "Giant Circle" screen, or the smaller, conventionally-shaped picture. The Chicago firm, located at 6001 W. Dickens Ave., also announced that the "black" Glare-Ban tube provides a picture with greater contrast and clarity, and is also devoid of eye straining properties.

Although the sets have automatic, single knob tuning and one control that automatically locks in both audio and video, for minor adjustments,

there are four controls governing fine tuning, vertical motion of the picture, brightness, and contrast. Another fea-

ture of the *Zenith* "St. Regis" is a specially-designed, built-in turret tuner with provisions for receiving ultra-high frequency.

Besides the screen and three rectifiers, there are 25 tubes and an extra heavy power transformer. Cabinet is in Honduras mahogany veneers, 35" high, 23 1/16" wide, and 19 5/16" deep.

ALTEC TV LINE

Altec Lansing Corporation, 161 Sixth Avenue, New York 13, N. Y., long known in the sound reproduction field and motion picture industry, has introduced its first line of TV receivers

In the announcement, a "new and unique" easy turning channel selector providing for positive station tuning was specified as one of the features of the grouping. *Altec Lansing* also stated that the sets would have the benefit of an exclusive television cir-

cuit design, for which an increase of 40 per-cent in picture quality was claimed.

Table and consolette models are both available in mahogany, walnut, or blonde finish, and table sets are $367.00, while consolettes are $408. For the chassis alone the price is $308.

ADMIRAL 16-INCH TV SET

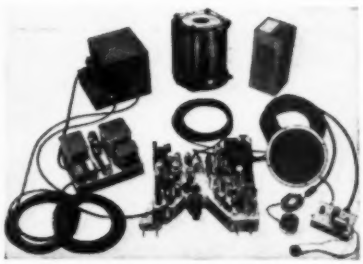
At a distributor meeting recently, *Admiral Corporation*, 3800 Cortland Street, Chicago 47, Ill., announced that with the introduction of its new 16-inch tube console, its line would now offer a choice of 10-inch, 12½-inch, and 16-inch receivers.

In this new set, Model 25A16, complete 12-channel coverage is provided,

COMPLETE SET OF COMPONENTS

NOW AVAILABLE FOR A TRULY HIGH GRADE, DELUXE SCHMIDT-TYPE OF

LARGE SCREEN PROJECTION SYSTEM



NO FINER PROJECTION SYSTEM AVAILABLE AT ANY PRICE!

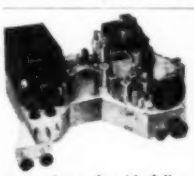
This 37-tube Projection Chassis incorporates all the dependable features of the RCA 630 plus dual 6BG6 Sweep Amplifier for fully sweeping the 5TP4 tube. Set also incorporates cut-out relay for turning off high voltage power supply in the event of any horizontal or vertical sweep failures, affording complete protection for projection kinescope.
The set has cables permitting remote operation up to 50 feet, making it ideal for custom installations.
The 4 video stages allow unparalleled contrast and brightness.
The 11-tube Regulated 30KV Power Supply, available only with above kit, allows any brightness or contrast settings with no change of focus or blooming of any kind on projected picture.
Switch at rear of chassis enables set to be used for rear or front projected pictures.
Kit available with System No. 1 for 15" x 20", System No. 2 for 3' x 4', System No. 3 for 6' x 9'.
The complete 48-tube system including 12-inch speaker is now available. WRITE FOR SPECIAL PRICES TODAY.

SCHMIDT OPTICAL SYSTEM

for bright, large screen Television Projection
For 15" x 20" size picture, System No. 1 is required.
For 3' x 4' size picture, System No. 2 is required.
For 6' x 9' size picture, System No. 3 is required.
The above picture sizes can be varied (smaller or larger) to get exact dimensions required by simply twisting control in front of the barrel. For instance, on a 3' x 4' size the picture can be varied from below 2' x 3' to 6' x 4½'. Folder with complete information, dimensions and price of Schmidt System is available. Write for it now!

A REAL SALES BOOSTER!

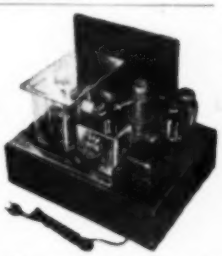
Give Your Customers a 22" Direct View Circle Picture.
The 16" glass tube with a 180 degree sealed lens giving bright, sharp and largest direct view pictures is now available.
ON ORDER—30" direct view 20AP4 direct view capped tubes.
Send for our special prices on these new moneymakers. Tubes can be used with above 630-type chassis or in any chassis except electro-static types.



630-TYPE CHASSIS

less Kinescope. A carefully built and tested chassis available at **$175.00**
Complete conversion data included upon request to convert the chassis to a projection unit with full sweep, including cathode follower and additional video stages for 50-foot remote operation with above Schmidt optical barrel.
630 chassis also available with voltage doubler for use with 15" tubes up to the 20" size.

30 KV RF POWER SUPPLY



For Television or Experimental Uses.
Dimensions—
Length 14¼",
Width 11½",
Height 12⅛"
The above unit is complete including low voltage DC supply. The voltage is variable from 15KV to 30KV through a control on the front panel. The high voltage unit includes a focus control and voltage tap variable from 4KV to 6KV for use with 5TP4 Projection Kinescope Tube. The high voltage 30KV-6KV cables are 3 ft. 11 inches in length and are of the safety type. Utilizes 6 tubes.
Net Price Complete.....**$99.50**

HIGH VOLTAGE COILS

5 KV.....	$ 3.25
10 KV.....	7.75
15 KV.....	7.75
25 KV.....	35.00
30 KV.....	35.00

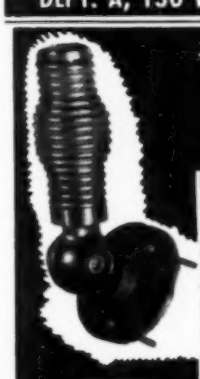
FILAMENT TRANSFORMER for 1B3 Rectifier Tube for use in 200 KC RF Power Supply. **90c**

REAR PROJECTION PLASTIC TELEVISION SCREENS—only **$3.00** per square foot.

5TP4 PROJECTION KINESCOPE TUBE
Send for our special price.

INCLUDE 25% DEPOSIT WITH ORDER, BALANCE C.O.D.

SPELLMAN TELEVISION CO., INC.
DEPT. A, 130 WEST 24th STREET, NEW YORK 11, N. Y. • AL 5-3680



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ANTENNAS *Master Mobile* MOUNTS

Presents a QUALITY LINE OF MOBILE ANTENNA EQUIPMENT...Priced Right!

MASTER MOUNTS...
- have hefty shock absorbing springs (no more broken or bent antenna whips, due to impact shock) – two spring types, straight and double tapered to meet individual requirements.
- have two types for body and bumper mounting installations – Unique design allows Body Mounts to fit any auto body contour – Bumper Mount clamps to bumper in few seconds.
- have heavy bakelite or micarta insulation for low losses.
- have heavily plated cadmium on all metal surfaces.
- are featured in two types—Stainless Steel and Cad plated, tempered spring steel.
- SERIES 100 in Stainless or Cad plated steel with ⅜" stud fitting on end to screw directly into mount, available in 72", 78", 86", 90" and 96" length, – 86" Cad or Stainless. Net Price **$4.65**
- SERIES 106 in Stainless or Cad plated steel – same as Series 100 except has plain end to fit in MODEL 92 extension – 86" Cad or Stainless . . . Net Price **$3.95**

MASTER EXTENSION...
- MODEL 92 – provides change in length of up to 18" for series 106 whip antenna. Collated head allows easy adjustment and locks securely. MODEL 92 Extension. Net Price **$2.95**

MASTER WHIP ANTENNAS...
- are one piece centerless—ground tapered and designed to prevent excessive swinging – with-stand rigorous treatment.

All Master products are guaranteed one year against defective materials or workmanship.

BODY MOUNT MOD. 132 **$7.95** NET

BUMPER MOUNT MOD. 138 **$5.95** NET

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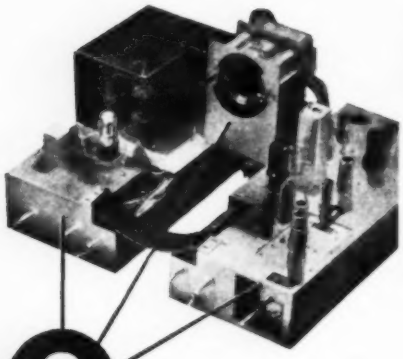
General Sales Agent Harry Appleton Co. 311 W. Pico Blvd., Los Angeles 15, Calif.
"Dealer Inquiries Solicited"

NATIONAL TELEVISION

Chassis



3 UNIT DESIGN

FITS ANY CABINET

The most versatile television chassis yet designed! Three basic units — power supply chassis, RF chassis and deflection yoke assembly — may be placed side by side, one above the other, etc., to conform to any cabinet. Simply plug in the cable connectors. Each unit is soundly engineered and built to famous National standards of performance.

1. Choice of 10" (TV10C) or 12½" (TV12C) chassis. **2.** Tunes all 12 channels. **3.** Wired, pretuned and tested—not a kit. **4.** RF stage employs tuned grid and plate for maximum gain and optimum band width. **5.** Unique 36 mc IF minimizes interference. **6.** Fine tuning control covers range of 2-3 mc. for maximum tuning accuracy. **7.** Improved intercarrier sound. **8.** Magnetic deflection and "fly-back" high voltage supply. **9.** 72-ohm unbalanced and 300-ohm balanced inputs. **10** Supplied with two six-inch PM speakers.

Specify either TV10C or TV12C when ordering **$149.50**

(less picture tube)

National

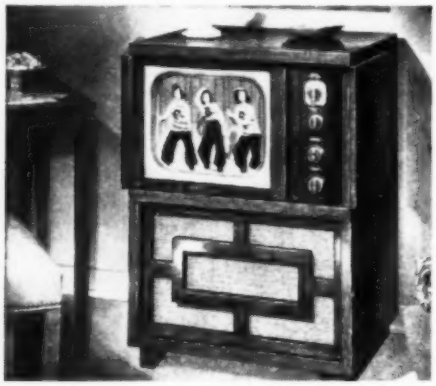
EST. 1914

NATIONAL COMPANY, Inc.

MALDEN, MASSACHUSETTS

as well as a turret-type tuner that may be adapted to any new channels that may be assigned.

Available in walnut, mahogany, or blonde veneers, the cabinet is in the modern style, and measures 26 inches



wide, 35 inches high, and 23 inches deep. The direct-view picture screen and vertical control panel are concealed behind double doors opening flush against the cabinet sides. Retail price is $399.95.

MAHOGANY "MODERN"

A specially-styled cabinet in the modern genre is the latest console to be introduced by *Freed-Eisemann*, 200 Hudson St., New York 13, N. Y. The company stresses the fact that this new cabinet, far from being only a conventional bleached wood version, was designed to conform, with its functional lines and original styling, to the demands of the most style-minded homemaker.

Rendered in mahogany in a bisque finish, with solid brass knobs, the cabinet is provided with double doors that conceal the picture tube and controls

when they are not in use. Carrying out the authentic modern design is the rattan speaker grille.

Aside from its modern treatment, this cabinet is identical in its equipment with the company's Hepplewhite console. In addition to a 16-inch picture tube and 29-tube circuit, the "Modern" employs a 12-inch high-fidelity loudspeaker and audio system with a phonograph connection, and the entire unit retails for $495.

—30—

Fix your eyes on these

BEST BUYS

BC375 TUNING UNITS

Plenty of good transmitting coils, condensers, switches & chokes. TU7, 8, 9, 10 available. Shpg. wt. 20 lbs. Used, clean, ea., **$1.45.**

SCR274N RACK

FT226A dual-transmitter rack includes two plugs which fit back socket of ARC5 & 274N receivers. Shpg. wt. 6 lbs. NEW, **59c.**
FT331A quad-transmitter rack. Shpg. wt. 8 lbs. NEW, **89c.**

BC348 POTENTIOMETER

Dual-section volume control. NEW, **$2.25.** Plug, **35c**

BC312 DYNAMOTOR

Use this one to power small receiver from a 6-volt car battery. DM21M 14-volt input, 230 volt 90 milliampere output w/filter & spare brushes. Shpg. wt. 8 lbs. NEW, **$2.45.**

CONTROL BOXES

BC732A switching and volume control for BC733 localizer receiver. Includes plug PL256. Shpg. wt. 2 lbs. Used, clean, **89c.**
TA12 Control Box w/plug. Shpg. wt. 5 lbs. NEW, **$3.95.**

ARC5 SHAFT

Complete 81" flexible tuning assembly used in aircraft for remote control of ARC5 & 274N receivers. Includes MC211A Right-Angle drive. Shpg. wt. 3 lbs. NEW, **$1.65.**

ARB RECEIVER CRANK

Includes dial. Shpg. wt. 2 lbs. Used, **89c.** 13-foot flexible tuning shaft (shpg. wt. 10 lbs.), **$1.95** extra.

Include sufficient postage — we refund excess.

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482 SUTTER AVENUE
Brooklyn 7, N. Y.

$39.95

HAS THE SENSATIONAL NEW EICO 400-K 5" Scope Kit IN STOCK!

International Short-Wave

(*Continued from page 112*)

amid severe *CWQRM* 2000-2100. (Peddle, Newfoundland)

Haiti—SWBC stations heard using new calls but amateurs seem to still be using old HH-calls. (Peddle, Newfoundland) Station 4V2S, 5.951, Port au Prince, listed with 300 watts, noted in New York with Spanish and *English* 2000-2045. (Bellington) Normally uses French mostly. However, Balfe, Mass., has just received a *QSL* card from the station (card must be an old one as still lists call as HH2S), shows power 300 watts, frequency 5.945; closing announcement at around 200 is in French, Creole, and *English*, always preceded by "The Swan" by Saint-Saens; *QRA* is P.O. Box B-81, Port au Prince, Haiti.

Holland — PCJ, Hilversum, is reported to have put into use a new 40 kw. transmitter on its 11.73 and 17.775 channels. Is now scheduled to the U.S.-Canada daily 2130-2230 on 11.73, 9.59, 6.025. (Day, Mass.)

Honduras—HRP1, 6.351, San Pedro Sula, listed 500 watts, identifies at 2145; all-Spanish. (Leinbach, N. Y.)

Hungary—Radio Budapest's 9.825 channel is no longer being heard in Newfoundland; spot is covered by *BBC* afternoons.

By this time Budapest should have increased power and may have extended schedules. Operates on 6.247, 9.820. Increase in power is believed to be from 400 watts to 2 kw.

India—The 17.84 channel is good in Australia 0300 with news. (Sanderson) This frequency noted in W. Va. 1915 with news to 1945, then in native language. (Arthur)

The *NZ DX-TRA* recently carried this data about AIR—India ranks fourth among the world's users of broadcasting, frequencies rank after Britain, U.S.A. and Russia. Three new 100 kw. s.w. transmitters are to be installed. External Services carry 25 news bulletins each day in 13 languages. Indian radio stations broadcast for 200 hours per day.

Current schedules of AIR, received airmail, are:

Delhi—VUD2—10 kw., 7.290, 2100-2300; 9.630, 0200-0400; 7.290, 0630-0800; 4.960, 0815-1230. VUD3—5 kw., 15.290, 2030-2230, 0200-0240; 17.760, 0300-0400; 17.830, 0730-0750; 15.290, 0830-1100; 9.590, 1130-1230. VUD4—10 kw., 11.850, 2030-2230, 0200-0400, 0730-1230. VUD5—100 kw., 15.190, 2030-2230; 15.210, 2300-2330; 21.510, 0230-0330, 0600-0800; 17.830, 0830-0915, 1000-1040; 15.210, 1100-1230; 11.710, 1400-1500; 17.840, 1930-2015. VUD7—100 kw., 11.790, 2030-2200; 9.565, 2215-2310; 17.830, 0230-0330, 0430-0530; 15.160, 0615-0730; 9.590; 0745-1045; 17.830, 1110-1330; 9.620, 1400-1500; 11.890, 1845-1900, 1945-2000. VUD8—7.5 kw., 11.870, 2030-2115; 7.275, 2130-2215; 11.830, 0220-0400, 0700-0915; 7.275, 0945-1330. VUD9 — 7.5 kw.,

MERCURY PRECISION THERMO-REGULATOR
Instant Action!
Dual Ckt 105° & 32° F. Extremely Sensitive & Accurate—forMost Exacting Requirements—FIRE PREV.,RESEARCH, LAB, FREEZE PT CONTROL,orMAX-MIN TEMP control. 4½" L. BRAND NEW! Boxed Individ w data&Ckt. List Over $20.SPECIAL **98c**

Sig Corps Dry Batteries—Gtd BRAND NEW Shelf Dated—Tested—Guaranteed.
BA34 7½ 6 4½ 3 /1½Neg Volts 39c
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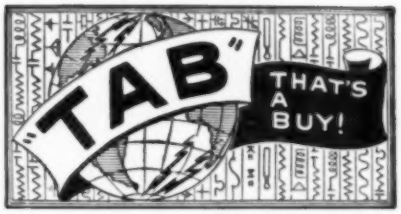
BA36 45 22½V Burg5308 89c
BA37 1½V Walky-Talky 29c
BA38 103½V Wky-Tky..$1.49
BA39 150/7½VBurgFSA100 ..... $1.69
BA40 90/11½V Burg4GB60 ..... $1.19
BA41 60/25½/4½V 89c
BA43 90/45/1½V 98c
BA51 67½ MiniMax 89c
BA205U 3V Burg F2BP..8 $1
WESTON STANDARD CELL 1.0014VAverageUnMtd $5.98



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"Tab"—Specialists in Precision Resistors
We Ship Types in Stock—Accuracy up to 0.1 Percent

0.116	75	350	699	1830	2463	5910	14250	32000
0.42	80	360	700	1865	2485	6000	14400	33000
0.325	81.4	366.6	711	1892	2490	6100	14500	35000
0.607	88	370	733	1894	2500	6125	14550	37000
0.7	89.8	375	740	1895	2525	6140	14600	38140
1.03	90	380	750	1896	2400	6280	15000	38500
1.3	95	389	800	1897	2625	6300	16000	39000
1.75	100	390	806	1898	2635	6495	16500	39500
2.5	101	400	850	1899	2700	6500	16800	40000
3	105	410	854	1900	2750	6840	17000	42000
3.83	105.7	414.3	899	1901	2850	6990	17500	43000
3.95	107	418.8	900	1902	2860	7000	17977	45000
4	120	425	910	1903	2870	7320	18000	47000
4.35	121.2	426.9	917	1904	2900	7500	18300	47500
5	125	427	946	1905	3000	7700	18380	48000
5.025	135	440	978	1906	3100	7717	18500	48660
6.25	140	450	1000	1907	3163	7900	18800	49000
6.5	147.5	452	1030	1908	3259	7930	19000	50000
7	150	460	1056	1909	3290	7950	19500	52000
7.8	160	470	1067	1910	3300	8000	20000	55000
7.9	165	475	1100	1911	3333	8094	20441	56000
8	170	478	1110	1912	3384	8250	20500	57065
10.38	175	480	1150	1913	3500	8500	21000	58333
11.25	179	487	1155	1914	3509	8700	21500	60000
12	182	500	1162	1915	3700	8770	22000	61430
13.52	182.4	518	1175	1916	3730	9000	22500	62000
14.2	200	520	1200	1917	3760	9100	22990	64000
14.25	209.4	525	1225	1918	4000	9445	23000	65000
14.5	216	540	1250	1919	4030	9500	23150	66600
15	220	550	1260	1920	4200	9710	23325	66650
16	220.4	575	1300	1922	4220	9800	23400	67500
17	225	580	1322	1924	4280	9900	23500	68000
19	230	588	1350	1926	4300	9902	24000	70000
20	235	600	1355	1960	4314	10000	24600	72000
22	240	612	1400	1980	4440	10430	25000	73500
23	245	625	1488	2000	4444	10500	25200	75000
25	245.4	633	1495	2045	4500	10600	25400	80000
26	250	640	1500	2080	4720	10900	25833	82000
28	260	641	1510	2095	4750	10936	26000	84000
30	271	645	1518	2141	4850	11000	26500	85000
31.5	275	649	1600	2142	4885	11400	26660	85750
37	280	650	1640	2145	4900	11500	27000	88000
48	286	657	1646	2150	5000	11690	27503	90000
49	289	665	1650	2160	5100	12000	28000	91000
50	299	670	1670	2180	5210	12500	28430	93300
51.78	300	673	1680	2187	5235	12600	28500	95000
55	310	675	1710	2195	5270	13000	29000	
56.7	311.5	680	1712	2200	5300	13100	29500	
60	320	681	1740	2250	5500	13500	29990	
63	325	684	1770	2300	5600	13550	30000	
68	330	689	1800	2400	5730	13600	31000	
74	340	697	1818	2450	5770	14000	31500	

Any Size Above, Each ..... 25c, Ten for $1.98

100000	150000	190000	238000	314000	420000	550000	761300
110000	155000	198000	240000	316000	422000	570000	800000
115000	160000	200000	245000	325000	425000	575000	813000
116667	165000	201000	250000	330000	450000	600000	850000
120000	166750	205000	265000	333000	458000	620000	900000
125000	167000	210000	268000	333500	470000	650000	933000
130000	169200	215000	270000	350000	478000	654003	950000
135000	175000	220000	275000	353500	500000	660000	
140000	180000	225000	294000	375000	520000	690000	
141000	180600	229000	300000	380000	521000	700000	
145000	185000	230000	307500	400000	525000	716300	
147000	186600	235500	311000	402000	543000	750000	

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Megohms		1.579	2	2.75	3.673	4.5	6.5	7.74	11.55
1	1.35	1.6	2.11	2.8	3.75	4.7	6.6	8	12
1.1	1.39	1.65	2.2	2.855	3.9	5	6.7	8.02	12.83
1.2	1.4	1.75	2.25	3	4	5.5	7	8.5	13
1.25	1.5	1.8	2.5	3.3	4.23	6	7.5	9.05	13.85
1.3	1.57	1.9	2.7	3.5	4.25	6.3	7.62	9.5	15
								10	20

Any Size Above, Each ..... 70c, Ten for $5.98

Vac Precision Hi-Volt Resistors
Megohms—12, .25, .6, .75, .83, .99, 1, 1.5, 2, 3, 3.75—1% Accy. Each ... $1.10; 10 for $7.50

Hi-Volt Precision Resistors
JAN-R20 MFC105 1Meg/1KV 1% Accy. Ea. $1.98; 6 for $10.00
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Hi-V Hi-Freq Resistors
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"IRC" MVP 2.5Meg/5W 7.5KV wkg
Sizes Above Ea. $1.08; 10 $8.98
"IRC" MVP 5Meg/10W/10KVwkg
"IRC" MVP 7Meg/10W/10KVwkg
"IRC" MVP 10Meg/10W/10KV wkg
SPRAGUE 12Meg/10W 10KVwkg
Sizes Above, Each $1.49; 8 $10.00
"IRC" MVZ 30Meg/20W/25KVwkg
"IRC" MVE 50 Meg/25W/40KVwkg
Sizes Above, Ea. $1.98; 6 $10.00

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5000ohms/20pos. .$1.98
5000ohms/30 pos. . 2.49
"TEE" dual 5000 ohms/20pos. 2.98
"IRC" atten 100,-000ohms/20pos. ... 1.98
"IRC" atten 200,000 ohms/20pos 2.49
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RHEOSTATS 25Watt IRC & OHMITE Slotted Shaft 350, 500, 1500 & 5000 ohms, 3 for $1.00

CRYSTAL DIODE SPECIALS!
1N21 ..39c; 3 for ..... $ 1.00
1N34 ..84c; 2/$1.59; 10/.. 7.89
1N48 ..$1.15; 2/$2.25; 10/. 10.49
1N51 ..$1.08; 2/$2.10; 10/. 9.49

ANTENNA UHF 12"/30cm AT5/ARR1 Usable Citz & Ham Band Coax TermInsltd SilvPl Cont wpf gask Flange&h'ware fixed & MOBILE mtg SPECIAL 39c; 4 for $1.00
Pl.259 for above 29c
Ant AN130B 33" Whip..98c
AntAN131A 11ft8sect ..$1.89
Ant MS49-52, 12½ftWhip $1.69
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Mast Base MP22 ..... $3.95
Mast Base MP48 ..... $3.98

HI-FI AMPLIFIER KITS —10 Watts HIGH FIDELITY KIT—6B4/2A3 Output RCA Chassis $14.95
SUPER HI-FI KIT—Pre-Amp Plus Separate Bass & Trebie Ckts. Write for Full Details.. $24.95

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Plus data for 24V or 110V60 cyc oper. Used, Tested. Sensational Buy!
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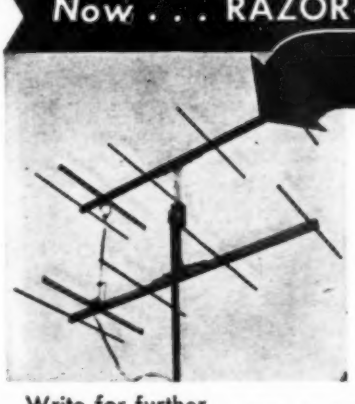

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- **Extremely rugged . . . yet light-weight**
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- **Made of Dural; stainless steel fittings**
- **Absolute lightning protection**
- **Very high front to back ratio.**
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1T4	6AG5	6C6	6SA7	12A8	12S8	35A7GT	47	84
1T5	6AK5	6D6	6SD7	12AL5	12SA7GT	35	50	85
1U4	6AL5	6F5GT	6SF5	12AT6	12SF5	35B5	50B5	117Z3
1U5	6AQ5	6F6GT	6SJ7	12AT7	12SJ7	35C5	50C5	117Z6
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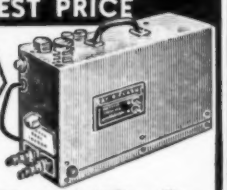

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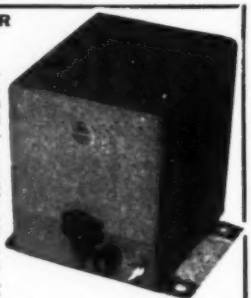

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Bombay—VUB2, 10 kw., 7.240, 2100-2230; 9.550, 0215-0400; 7.240, 0630-0845; 4.890, 0900-1230. VUB3, 9.550, 2100-2300; 7.240, 0215-0400; 9.550, 0630-0845; 7.240, 0900-1230.

Calcutta—VUC2, 10 kw., 7.210, 2000-2200; 9.530, 0200-0430; 7.210, 0630-0800; 4.880, 0815-1230. VUC3, 9.530, 2000-2200; 7.210, 0200-0430; 9.530, 0630-0800; 7.210, 0815-1230.

Madras—VUM2, 10 kw., 7.260, 2030-2230; 9.590, 0200-0430, 0530-0630; 4.920, 0700-1200. VUM3, 0.25 kw., 9.590, 2030-2230; 7.260, 0200-0430, 0530-0630, 0700-1200.

Idonesia—Stark, Texas, has been hearing a *Radio Indonesia* outlet mornings on about 9.705; no further details. *Radio Sario*, Celebes?

YDE, 11.77, Batavia, heard 0400 with news, followed by music; Fort-de-Kock, 10.64, Sumatra, heard 0615 with Dutch news for troops and civilians. (Sanderson, Australia)

Radio Indonesia, 11.085.5 (measured), YDQ-3, Makàssar, Celebes, fair signal through *CWQRM* 0610-0645. *Radio Indonesia*, 10.367.5 (measured), Batavia, good signal through *CWQRM* 0750-0800. (Huse, Washington)

The 19.345 channel of *Radio Indonesia*, Batavia, heard in England 1230 with French program, then dance music; closed 1300 with native music after short news in French. (Pearce)

Charles Stuart, head of the *English Department* at *Radio Indonesia*, Batavia, was scheduled to leave Java in September for a year's study in England and the United States. (Cushen, N. Z.)

Solo, 3.330, Java, heard around 0600 in Dutch, then has news in Indonesian; YDA, 3.390, has modern *English* numbers around 0630. (Cushen, N. Z.)

Iran—EQB, 9.660, is scheduled daily now 0345-0600. (Bluman, Israel, via ISWC) EPB, 15.100, is still good level in Eastern U.S., 1330-1500, news 1400; widely reported.

Israel — Kol-Yisrael, 9.000, Tel-Aviv, has been heard in Eastern U.S. frequently this summer, opening 2245; at 2250 has setting-up exercises, followed 2300 by news in Hebrew (read by a woman). Bellington, N. Y., recently heard Kol-Yisrael with weak signal opening 2245 on about 6.83. Haifa also parallels the Tel-Aviv outlets, using 8.170 which channel has not been reported to me as audible in the U.S.

Kol-Yisrael has concluded tests on 11.820, and is now operating at 2245-0100, 0300-0715, 0830-1515, on 9.000,

6.830, 8.170. (Bluman, Israel, via *Radio Australia*)

The Army of Israel, "*Forces Broadcasting Service*," Tel-Aviv, is scheduled on 4X4EA, 6.725, at 2330-0130, 0530-0730, 1300-1500; *no English*, mostly in Hebrew and with music. The Galilean Regional Service, 7.000, Tiberias, broadcasts in Hebrew, but has not been reported lately; the Negev Regional Service was operating on 6.700V, around 1130 or 1230 some time ago, but has not been reported as heard recently.

Japan—JKK, 6.015, Tokyo, good signal 0728-0800; JKC, 7.258, Yamata, strong signal 0746-0800; JKE2, 4.860, Yamata, strong 0808-0830; JKF2, 4.910, Nasaki, strong 0805-0830, but at 0828 has *CWQRM*. (Huse, Washington)

Korea—HLKA, 7.933 and 2.510, 5 kw., Seoul, are both good in New Zealand to sign-off 1030 with a long announcement in *English;* now operated by the Republic of Korea. (Cushen)

Lebanon—Radio Lebanon, Beirut, broadcasts to Lebanon and the Near East on 8.020 and 730 kcs. at 2330-0100 (Sundays 0030-0200 and 0430-0545), 0530-0730 (Sunday from 0430); Sunday *only* at 0930-1030; 1015-1030 on Tuesday *only* for Lebanese Army; daily 1030-1600, with *English* news at 1030 then musical program in *English* to 1130. (Norris, Lebanon)

Luxembourg — Radio Luxembourg, 6.090, has *English* on Sundays at various times around 1130-1630; expects to increase *English* programs come winter. Reception reports are always welcomed and should be sent to *Radio Luxembourg*, 36 Davies St., London, W1, England, or direct to Luxembourg. (Patrick, England)

Malaya — Kuala Lumpur, 6.025, heard 0615 with request program of music, news 0630. Singapore's *Radio Malaya* outlet on 7.22 heard 0630 with news and music, good level in Australia. (Sanderson)

Monaco—Radio Monte Carlo is currently using 6.035, 9.785. (Peddle, Newfoundland) Noted on Sundays with modern dance music 1600-1700, all announcements in French and *English*. (Pearce, England) The 9.785 channel is fairly good level signing on 0100, news in French follows; the 6.035 channel is audible but is much weaker here in West Virginia.

Mozambique — CR7BM, Lourenco Marques, is reported relaying a Portuguese program on 3.465 and 4.820 at 0045-0100. (*Radio Australia* via Grove, Ill.) CR7BE, 9.76, is heard in Sweden at 1140-1250. (Nordh) The *English* transmission from CR7BE actually runs 0000-0300, says Ridgeway, South Africa, and is carried in parallel over CR7BU, 4.92. However, it generally fades out in America around 0100, although is good at start. Uses commercials and has frequent time checks and identification. The outlet on approximately 9.65 carries Portuguese at the same time, is quite good level here in W. Va.

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1U4	6BA7	12AU7	9001
1U5	6BE6	12AX7	9002
3A4	6BF6	12BA6	9003
3Q4	6BH6	12BA7	954
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3D6 1299	.39	954	.39	9002	.49
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5FP7	1.95	1625	.39	RK34	.49
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New Caledonia—*Radio Noumea* appears to be using a *new* outlet on 3.410 at 0200-05300 daily in parallel with the 6.000 transmitter (latter suffers severe interference from Manila); announces "La Voix de la France dans le Pacifique, Noumea"; the Noumean outlet, *"Radio Electric,"* in 1941 used this (3.410) channel with 100 watts so it may be that old transmitter has been brought back into service; signal very strong in New Zealand. (Cushen)

New Zealand—*Radio New Zealand*, Wellington, has made some frequency changes and now appears scheduled 1300-0420 on ZL3, 11.78, 0425-0630 on ZL3, 11.81, and 1330-0630 on ZL4, 15.28; also is reported irregularly using ZL2 on 9.54 or 9.78 (latter mostly).

Northern Rhodesia — Lusaka has dropped its 31-m. channel; now transmits on 7.26 with news 1000; high level in South Africa. (Ridgeway)

Norway—*Radio Norway* now has a *letterbox* program on Saturdays 1400-1500 on 9.610, 15.170, 17.825, 21.730. (Swedish DX broadcast) Letters are read and answered in Norwegian or *English*, depending on the language in which they were written. (Worris, N. Y.)

Pakistan—*Radio Pakistan*, Dacca, has moved to 15.335 from 15.27, where it is difficult to hear. Still carries news 0700. (Stark, Texas, others) Heard in North Carolina occasionally around 0645-0705. (Ferguson) Reported testing on 17.835 at 0330-0430; may open on this channel as early as 2200 or 2230, however. News is scheduled on the 15.335 channel at 2100, 0110, 0700, 0945. (Cushen, N. Z.) Transmissions are listed 2030-2200, 0030-0230, 0600-1130. Lahore is officially listed on 11.748, scheduled 2100-2300 (Sat. to 2330), 0130-0330 (Fri. to 0230), and 0700-1230.

Panama—HOLA, 9.505, Colon, noted with *English* request program 2200-2245. (Hankins, Pa.) May be a Saturday *only* feature?

Paraguay — ZPA3, 11.850, *Radio Teleco*, Asuncion, is coming through fair in Connecticut around 1700. (Boice)

Philippines—DZH3, 9.45, heard 0400 with "Where to Dine" session, news and music; DUH2, 11.84, heard 0415 with "Sunset Rhythm" series of programs; DZH4, 6.000, heard 0600 with "Smile a While" session of music. (Sanderson, Australia) DZH3 has been reported moved from 9.500 to 9.45 and/or 9.40, but later reports indicate is still on (announced) 9.500.

Reunion—A Swedish *DX*-er has received a letter from Monsieur P. Poirer, chief of *Radio Saint Denis* on the island of Reunion, who thinks that the Swede must have a good receiver and a very good antenna since he is able to hear this small station at such a great distance. (The receiver, incidentally, is a common Swedish 6-tube set and the antenna is 60 metres long.) *Radio Saint Denis* operates two 200-watt transmitters on 4.800 and 7.170, respectively, on the air daily 2200-2230, 0845-0930; reception reports are greatly appreciated; *QRA* is Radio Saint Denis, Saint Denis, Reunion. (Swedish DX broadcast)

Roumania—*Radio Bucharest*, 9.250, heard daily signing on 0100 for a short newscast (presumably in Roumanian), then leaves the air. (Pearce, England)

South Africa—Stephan, South Africa, says usual times of operation of SABC outlets are weekdays 2345-0130, 0315-0710, and 0900-1605; Sundays 0055-0115, 0315-1605. He details programs as follows:

Johannesburg—Programs in Afrikaans, 3.450, 1050-1605 daily; 6.007, 2345-0130 weekdays, 0055-0110 Sundays; 9.523, 0315-0710, 0900-1040 weekdays, 0315-1040 Sundays. Programs in *English*, 4.373, all usual times of operation; 4.800, 2345-0130 weekdays, 0055-0110 Sundays, and 1120-1605 daily; 9.870, 0315-0710, 0900-1110 weekdays, 0315-1110 Sundays.

Cape Town — Programs in Afrikaans, 5.880, 2345-0130 weekdays, 0055-0130 Sundays, and 1200-1605 daily; 9.610, 0315-0710, 0900-1145 weekdays, 0315-1045 Sundays. (This one does carry some *English*.—KRB)

Pietermaritzburg — Programs in *English*, 4.878, all usual times of operation. (Swedish *DX* broadcast)

ZRB, 9.110, Pretoria, has news 0000, BBC news relay 0100. (Bellington, N. Y.) This one is scheduled to operate in parallel on 9.110 and 6.210, and relays mostly SABC broadcasts.

Southern Rhodesia — Salisbury is testing on 3.320 to 1500 daily; relays the usual Southern Rhodesian programs, but at 1445 and 1500 makes its own announcement from the transmitter; asks for reports from listeners in Northern and Southern Rhodesia to Chief Engineer, P.O. Box 1380, Salisbury, Southern Rhodesia. (Cushen, N. Z.) The 3.320 channel is listed as ZEAF, with 15 kw. Umtali, 6.082, Salisbury, 6.000, and Bulawayo, 3.800, are scheduled occasionally with special events 0300-0430; Sunday *only* 0330-0335 and irregularly to 0430; sometimes 0430-0615 (BBC *English* news relay 0600); and Bulawayo, 3.800, Salisbury, 3.685, and Umtali, 3.400, are scheduled irregularly 0815-1055 and on Fridays 1000-1055, and irregularly at 1055-1500 or irregularly to 1530 (sign-off varies); this is all Home Service programs.

Sweden—*Radio Sweden*, 10.780, heard 1900-2030; opens with news and commentary for first 15 minutes in *English* period; remainder of program is in Swedish to 2000 when a further *English* program (*"Sweden Today"*) is given; some days has Esperanto at 2015. (Ormond, N. C.) By this time may have extended the transmission by 15 minutes, that is to 2045, at least on some days.

Radio Sweden now has a program in *English* for scouts every first Sunday of the month at 0230, 6.065, 15.155; 1030 and 2030, 10.78, 15.155. (Swedish *DX* broadcast)

Syria—Damascus, 12.000, heard 1730

with Arabic program of news and music, some *QRM*. (Sanderson, Australia) Has news now at 1400. (Swedish DX broadcast)

Tahiti—A *new* station widely heard in the Eastern U.S. announcing as *Radio Tahiti* appears to operate 2315-2359 daily on approximately 12.075 (may be as high as 12.085). Opens with Hawaiian-type music, identifies in French, and then continues with news in French (this may be taken from *Radiodifusion Francaise* programs). Around 2330 identifies again, "Ici Radio Tahiti, Papeete." Music of good quality and various kinds follows to around 2350 when signs off the French portion of the broadcast and says will continue in "Langue Tahitienne." Also that will return at 1815 local time (which would be 2315 EST). One night after the news, the announcer said something about the program being relayed by various stations in Comorien (language of Madagascar), and so on. After signing off in French at around 2350, there are a few bars of Hawaiian-type music, then a man gives news in Tahitian language to around 2358 when the chorus *only* of "La Marseillaise" is played and the station leaves the air. Usually has been a fair to good signal in the Eastern U.S., some nights perfectly in the clear, but on others has had *QRM* from a commercial (ship-to-shore) phone. I hope to have further details next month. Also reported by McPhadden, California, with S7 to S9 signal; McPhadden informs me that the station is operated by the French Government. McPheeters, N. Y., heard the announcer say one night that the music was coming from the "Café Sélect" in Papeete.

Tangier—It is reported that following an agreement with the French, the *"Voice of America"* has started construction of six high-powered s.w. radio relay transmitters at Tangier. Four of the transmitters are to be 100 kw. in power and two will be 50 kw. Two of the transmitters are expected to be carrying the *"Voice's"* news and features eastward within two months with another two units scheduled to be in operation within eight months. The cost is reported to be $1,500,000. The added facilities will augment four relay transmitters in Munich, Germany, and five leased from the *BBC*. The Munich wavelengths and time budget are said to have been completely saturated for some time with the stepped-up broadcast schedule of the official radio service. Construction of the transmitters at Tangier followed extended negotiations with France on details of the lease. The French will use the transmitters several hours daily. (Worris, N. Y.)

Thailand—Bangkok is heard on 7.005 at 0600 with Thai program of news and music. (Sanderson, Australia) This outlet is officially listed 7.023. *Radio Australia* reports Bangkok schedules as 1900-2000, 6.010,

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7.105, 11.650; 0200-0630, 6.010, 11.650; 0700-1030, 6.010, 7.105, 11.650. (Worris, N. Y.)

Trinidad — VP4RD, 9.625, Port-of-Spain, heard several times recently asking for reports. (Balfe, Mass.) Opens around 0500.

Uruguay—CXA19, *Radio El Espectador,* Montevideo, states it is operating on 11.835 at 0600-2200, and says *a new transmitter of 20 kw. is under construction and will be used in the 19-m. band.* (Swedish DX broadcast) The 11.835 channel is now coming in well around 1900. (Bellington, N. Y.)

U.S.A.—WRUW, now 50 kw., is to be operated at 120 kw. during *"Voice of America"* relays, but will remain 50 kw. during World Wide Broadcasting Foundation broadcasts. Construction is still under way on facilities to increase WRUW's carrier power to 250 kw. A newspaper dispatch from Boston states that Walter S. Lemmon, president of the WWBC, had announced that the Federal Communications Commission had authorized the increase of one of its five Boston senders to 120 kw., more than doubling its power. "This new power amplifier," Mr. Lemmon was quoted, "will be used to boost the service of the State Department programs to listeners in all of the countries behind the Iron Curtain, and to assist further the efforts of the State Department to overcome the Russian jamming of its transmissions from the United States." The 120 kw. station is expected to be in operation by next summer, the dispatch stated. It was added that reports during the past year indicated the Boston stations had been "heard clearly in fifty-six countries." (Worris, N. Y.)

U.S.S.R.—Radio Moscow, 11.63, has *English* transmissions to Britain at 1330-1430, 1530-1600, 1630-1700; also carries Latin American Service 1900-2100 (approximately); usually fair to poor signals except during Latin American service (in Spanish) which usually is good level, easily read; at other times there is some *CWQRM* on the channel. (Ormond, N. C.)

In the North American Service, the *Letterbox Program* is Saturdays 1900; frequencies in use 1820-1930 are 11.88, 11.96, 15.23, 15.31, 15.39; the 2030-2215 period is over the same channels *plus* 15.41. (Ormond, N. C.)

Moscow noted on 21.580 (?) at 1355 with *English;* in French 1430. (Nordh, Sweden)

Vatican—At end of the *English* period 1315-1330, HVJ announces channels of 9.640, 5.970, 11.740; has French transmission 1345 on 5.970, 6.190, 9.640. (Pearce, England)

Yugoslavia—Stark, Texas, has heard *Radio Belgrade,* 9.505, signing off in French (saying "Ici *Radio Beograd*") at 2359.

* * *

Last Minute Tips

Radio Italiana verified by airmail with QSL card showing view of Colosseum in Rome. Correct QRA is *Radiodiffusioni per L'Estero,* Via Veneto

56, Roma, Italy (Italia). Rome is currently transmitting on 9.63, 11.81, and 15.12. Schedules are—0500-0530 to Far East and the Pacific on 19- and 25-m.; 0500-0520 Italian; 0520-0530 *English*. At 0900-1025 to Europe on 19- and 25-m.; 0900-0915 Slovak; 0915-0930 Polish; 0930-0945 Hungarian; 0945-1025 (except Sundays) Italian; 0945-1000 (Sundays only) Italian; 1000-1025 (Sundays only) "Problemi della Radio" (in French-Swedish and *English*-German on alternate Sundays). At 1031-1045 to North America on 19- and 25-m., Italian. At 1050-1230 to Europe on 19- and 25-m.; 1050-1105 Yugoslavian; 1105-1125 (Sundays and Thursdays only) Dutch; 1105-1125 (except Sundays and Thursdays) Danish; 1125-1200 French; 1200-1230 Turkish. At 1235-1300 to East Africa on 19- and 25-m.; 1235-1250 Italian; 1250-1300 dialects. At 1300-1340 to Europe on 25- and 31-m., German. At 1340-1410 to South Africa on 25- and 31-m.; 1340-1355 *English;* 1355-1410 Italian. At 1410-1515 to Europe on 25- and 31-m.; 1410-1450 *English;* 1450-1515 Greek. At 1515-1545 to North Africa on 25- and 31-m., Arabic. At 1545-1700 to Europe on 25- and 31-m.; 1545-1615 (Sundays and Thursdays only) Norwegian; 1545-1615 (except Sundays and Thursdays) Swedish; 1615-1630 Roumanian; 1630-1645 Russian; 1645-1700 Czech. At 1710-1925 to Latin America on 19- and 25-m.; 1710-1745 Portuguese; 1745-1830 Spanish; 1830-1925 Italian. At 1930-2055 to North America on 25- and 19-m.; 1930-2015 *English;* 2015-2055 Italian. (Worris, N. Y.)

I have just received via airmail from Buenos Aires a neatly-printed schedule (in *English*) for S.R.I. *English* Language transmissions for the United States; listed for *only* LRY, *Radio Belgrano,* 9.455, daily 2115-0057.

Mafrak, approximately 8.100, Trans-Jordan, heard calling Fayid 0230. (Bluman, Israel, via *Radio Australia.*)

COCH, approximately 11.81, Havana, Cuba, now signs off 0000; transmits in parallel CMCH, 790 kcs., and announces *"Radio Cadena Habana."* (Mueller, Ohio).

OXI, 5.942, Godthaab, Greenland, *"Greenland Radio,"* heard in England 1630. (Staples.)

Prague's OLR4A, 11.84, has improved in quality and volume lately in the daily 1900-2000 beam to North America; *English* 1900; Czech 1920, and Slovak (relayed from Bratislava) 1940. (Worris, N. Y., Ferguson, N. C.)

Radio Rabat, 6.006, French Morocco, logged with *QRM* 1430 when had Arabic music; also heard around 1600 with announcement in French, *"Ici Radio Maroc,"* followed by French recordings. (Patrick, England.)

Tel-Aviv, Israel, noted on 8.170 at 1500-1515 with news. (Patrick, England.)

From Japan, Fellers airmails that the Peiping (New China) Broadcasting Station (Communist-controlled) operates on (announced) channels of 6.096, 7.500, 9.04, 10.26, and 680 kcs.

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50-50-20	150-25	29c
50-40	200-250	29c
50-30	150	29c
50-20-10-5	25-450	29c
40-40	350	39c
40-40	150	29c
40-30-20	150	29c
40-20-20	150	29c
40-20	400-450	39c
40-20	150	29c
35-30	150	29c
30-30	150	29c
30-20	150	29c
30-20-5	150-25	29c
20-20-20-20	300-275-245-22	39c
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200-40	10-150	29c
150-70-30	25-150	29c
100-80-40-30	25-150	29c
100-50-30	25-150	29c
100-40-20	10-15	29c
80-40-20	150-25	29c
80-40	150	39c
80	300	29c
50-50	150	29c
50-30	150	29c
50	450	19c
40-40	150	29c
40-20-20	150	29c
40-20-10	150	29c
40-10-10	450-350	39c
40	450	34c
40	150	29c
30-30-20	350-300-25	39c
30-15	150	29c
30	300	29c
20-20-20	400-300-25	39c
20-20-15	300-25-400	29c
20-20-10	25-400	19c
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15-15-10	450-350	29c
15-10	400	29c
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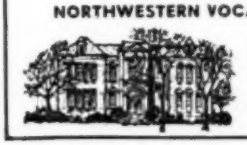

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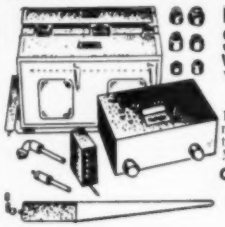

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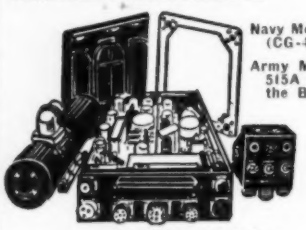

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(BCB). These outlets carry Chinese programs mostly, except 0830 when *English* news and commentaries are presented until generally around 0855. Nanking, 5.98, 9.73, relays this *English* period but is *not* announced. It is possible, Fellers adds, that Shanghai is currently operating on about 11.87, but *QRM* prevents positive identification of the station on that frequency which "seems" to carry the 0830 news.

Rangoon, Burma, is heard well in Japan on 6.035 in native after 0800; *English* 0900; Singapore on 7.20 is very strong level 0700-0930; Kuala Lumpur, 6.025, is heard fairly well at that time; *Radio Hanoi*, 6.19, Fr. Indo-China, noted with news in French 0700 but suffers bad *QRM* after 0730. (Fellers, Japan.)

Moscow transmits to Asia on 11.84, 15.14, 15.34 in *English* daily 0700-0800. (Fellers, Japan.) Is heard in U. S., best on 15.14 and 15.34.

DeSouza, Singapore, airmails me that *"Radio Republic of Indonesia, Sumatra,"* 11.640, Sumatra, is on the air daily 0630-0900. Identification is *"Radio Republic Indonesia,* Sumatra Udara." Has Javanese language period 0630-0730; Arabic music with Javanese announcements 0730-0800; news in *English* and popular Western music 0800-0830; last half-hour is devoted to Indian language programs; opens with playing of a popular Malay tune called "Bunga Raya." Reception is good in Singapore.

QRA for XEQQ, Mexico City, is P.O. Box 940. (Osterman, N. Y.)

Moscow is strong on 11.63 at 1430-1530, 1630-1700, 1730-1800; 7.29 is fair level. (Cox, Delaware.)

VLR2, 6.150, Melbourne, Australia,

DULL PICTURES IN TELEVISION RECEIVERS

By MATTHEW MANDL

MOST service technicians are familiar with the old adage about checking tubes first but too often neglect this sage advice when it comes to the picture tube of a television receiver. The reason, of course, lies in the inconvenience of handling such a large tube and in the difficulty of setting up test equipment for the various types and sizes encountered in daily servicing. Then, too, the symptoms are often such that they seem to indicate troubles in other parts of the receiver, rather than in the picture tube.

This is particularly true when the picture is dull and cannot be brought up by advancing the contrast and brilliancy control. The immediate assumption would be that the two controls, or the circuits associated with them, are defective. The high-voltage power supply, of course, would also be a likely suspect, and much time is lost in vainly checking one circuit after another. Eventually picture tube substitution solves the problem, but only after considerable man hours of servicing have been wasted. Much of this time can be saved by making a few simple checks and by careful evaluation of the symptoms observed.

When both brilliance and contrast are down, there is no need for checking any of the signal stages from the r.f. amplifier to the video amplifier, for even without a signal the raster should still be available on the screen. Inability to bring the raster up to full brilliance, however, could mean that the high-voltage supply or the tube is at fault. Inasmuch as the high voltage can be checked very quickly, this should be done with a v.t.v.m. of suitable range. Another method which will give an indication of the presence of the high voltage is to remove the high-voltage plug from the side of the tube and hold it within a quarter to a half-inch from its receptacle. A good, strong arc should result. Do not, however, draw a spark by holding the high-voltage plug near a ground point, since this will cause excessive high-voltage currents. Holding the plug near the receptacle to which it is connected will draw a spark without danger of overload.

Once the presence of high voltage has been established, it will be reasonable to assume that the yoke and horizontal sweep systems are functioning satisfactorily. (Since most sets other than the 7" ones employ the inductive fly-back type of high-voltage system, the horizontal sweep circuits, high-voltage supply, and yoke function are all interrelated.) A final check can be made regarding the bias on the picture tube, for an excessive negative potential between grid and cathode can also cut down picture brilliance. Once these few simple checks indicate normal voltages, a new picture tube should be tried. This procedure will save signal tracing time, waveform checks with the scope, and numerous other time-consuming procedures.

—30—

A dull picture, with poor whites and blacks will most likely indicate a faulty tube.

A good picture tube will have a wide latitude of ranges in contrast and brilliancy.

is sometimes heard with ABC news 0400. (Osterman, N. Y.)

A press dispatch from Warsaw states—"The 'Voice of Poland' intends to make itself heard in the far corners of the world with a *new* 200 kw. station." (Fried, Michigan)

"Radio Makronesio" is the Greek station on 7.040 opening 0000 with the Greek National Anthem. (Bluman, Israel, via *Radio Australia*)

CS9MB, 4.845, Ponta Delgada, Azores, is heard in Sweden at 1800. (DX-Radio, Sweden)

Radio Brazzaville noted recently on 17.84 with news 0715; had music 0730-0745 sign-off. (Stark, Texas)

Douala, Cameroons, has not been heard lately on either 7.950 or 9.145. (Peddle, Newfoundland)

Vatican Radio noted on 15.095 opening 1000 with news. (Fargo, Ga.) A frequency of approximately 9.645 is used in parallel and is heard in Britain. (Pearce, England) The 9.645 channel has been heard recently in New Zealand at 1315 with news.

The *"Hello, America"* broadcast on Mondays through Fridays from *Radio Nacional*, PRL-8, 11.720, Rio de Janeiro, Brazil, is now radiated at 2200-2215. Reports are welcomed. (Worris, N. Y., and others)

Radio Sofia, 7.670, Bulgaria, noted 2255-0045 and 0455-0610 (Sundays 2325-0030, 0455-0630); also noted with *English* 1720-1730 and 1845-1900; French 1710-1720, 1830-1845. (Staples, England) Peddle, Newfoundland, says that *Radio Sofia* is using only 7.670 now, despite some reports to the contrary coming out of Europe.

ZIM-8, 9.650, Cyprus, noted in England 1400 but heavily *QRM'd* by CR7BJ, Mozambique. (Staples)

Radio Beirut, approximately 8.030, now has English daily 1030-1130, news 1045. (Norris, Lebanon)

Tips just received via airmail from Dorothy Sanderson, Australia, include —ZBW-3, 9.525, Hong Kong, heard 0545, now in clear, *BBC* news relay 0600; BCAF, 11.68, Formosa, opens 0400 with march, Chinese news and Western music follow; BEA7, 11.83, Nanking, noted 0445 with Chinese news and Western music, fair signal; *Radio Ceylon*, 21.62, heard 0500 with request program of music and news.

A current list of Japanese stations received from *Nippon Hoso Kyokai* (The Broadcasting Corporation of Japan), Chiyoda-Ku, Tokyo, Japan, gives these schedules—JKL, 4.860, 5 kw., *Yamata*, 0400-0900; JKI, 4.910, 5 kw., *Nazaki*, 1425-1615; JKM, 4.930, 5 kw., *Kawachi*, 0410-0800; JKK, 6.015, 5 kw., *Nazaki*, 1445-0900; JKH, 7.257.5, 5 kw., *Yamata*, 1425-0800; JKJ, 7.285, 5 kw., *Nazaki*, 1525-0800; JBD, 9.505, 7½ kw., *Kawachi*, 0425-0800; JBD-2, 9.560, 5 kw., *Kawachi*, 0425-0800; JKL-2, 9.605, 5 kw., *Yamata*, 1425-0400; JKI-2, 9.655, 5 kw., *Nazaki*, 1625-0415; JKM-2, 9.695, 5 kw., *Kawachi*, 1525-0400; JBD-3, 15.225, 7½ kw., *Kawachi*, 1650-0415, and JBD-4, 15.235, 5 kw., *Kawachi*, 1650-0415. (Oskay, N. J., via NNRC)

Radio Brazzaville's 17.840 channel is

NOW *Astatic Research* AIDS TELEVISION PROGRESS WITH THE *Channel Chief*

MODEL AT-1 TELEVISION BOOSTER

LIST PRICE $49.50

New Astatic Booster Has Gain Equivalent to Two Ordinary Boosters . . . Covers All 12 Channels with Very Uniform Gain . . . Eliminates Sacrifice of Good Sound for Good Picture, or Vice Versa, with Dual-Tuning.

ADDITIONAL IMPORTANT FEATURES

1. Self-contained power supply operating from 115 volt, 60 cycle AC power line.
2. On-off switch allows booster to be switched in or out of the circuit at will.
3. Recessed pilot light indicates when booster is on.
4. Beautiful, furniture-finish mahogany cabinet (8½" wide x 6½" high x 7¾" deep) to complement fine home furnishings.
5. Simple to install and operate—complete instructions with each unit.

ASTATIC RESEARCH — which has led the march of progress in various sound reproduction fields since the company first pioneered in crystal microphones, phonograph pickups, cartridges, parts and accessories — now brings major new advantages in reception and tuning to the television field. The new Astatic device which makes it all possible is the Channel Chief, Model AT-1, a radically improved type of television booster. The common failing of many boosters — showing a "peak" on some channels and "fall-off" on others—has been eliminated. The Channel Chief provides extremely high gain — equivalent of two conventional boosters — uniform on all 12 television channels. Its dual controls allow separate tuning of picture and sound, with no sacrifice of one for the other. Or, if one signal is weak and the other adequate, both controls may be adjusted to the weaker to bring it in strong. A variable gain control permits reduction of signal strength to prevent picture distortion when the signal input is greater than that required for good definition. Altogether, the results are the considerable extension of fringe areas, good reception in areas previously rated as unsatisfactory, easier tuning and added selectivity on any receiver, elimination of the need for expensive outdoor antennas within service areas. The increased selectivity serves to reduce drastically, or eliminate, interference from adjacent channels, amateur and commercial fundamentals and harmonics in the receiver's I.F. range, FM stations and oscillators of nearby FM, TV and short wave receivers. No other booster can do so much . . . for your installation and service business, for the television receiver owner. Write for added details.

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Dynamotor DM-33A; 28 V-5 A; 575V-.16A			1.50
Dynamotor AD-2; 14V-3 A; 220 V-.06A			2.50
Dynamotor RL-24A; 28 V-1.3A; 240 V-.08A			2.85
Drop Line & Relay; WE = D161835B; Tel's			.38
BELL RINGERS; MC-131; also 5C-115 AC			.35
BATHTUB COND. 3X.1 mfd-400VDC; also .1X.1			.14
DUAL COIL SET; F-range 2040-3000 KC; N-range 6000-9050 KC; for RU-17 Aircraft			1.25
COIL SET & HAND CALL CHART; 16 steps; 2500-3200 KC; for GF Eq. WE = 47136			1.30
FUSES; Bussman 4AG5 (5 amps.) per M			5.00
FUSES; Littlefuse, non-renuable Cart.; per M			16.00
304-TH	9LP7	371B	.70
5CP1	3DP1	371A	.75
5AP1	8013	2X2	.25
5AP4	878	800	.65
4AP10	3B24	8013-A	1.50
$1.95	95c	9GP7	3.50
		864 per 100	4.85
		2X2A	.75

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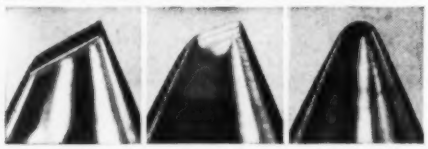

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AFTER ONLY 15 PLAYS ON MICRO-GROOVE RECORDS

Osmium Sapphire Diamond

The above photomicrographs (greatly enlarged) show the results of wear on stylus tips. Note the smooth, round, unchanged contours on the diamond styli. Compare them with the sharp chisel points worn on the sapphire and osmium tips. These sharp edges cut groove walls and destroy response.

Scientists find that diamond is

90 TIMES MORE RESISTANT TO WEAR AND 4-10 TIMES STRONGER

than sapphire—the next hardest material

Why subject the records you treasure to the ruinous grinding action of worn styli? You can preserve your collection—and save money too—by using a diamond stylus. It would cost at least $100 in sapphire stylus replacements to equal the durability and efficiency of one diamond stylus.

SPECIAL OFFER SAVES YOU MONEY

Remember that in many cases a stylus becomes worn—and causes damage—long before the defect is audible. It is far cheaper to replace your present stylus with a diamond than to have to replace or bear the loss of fine records. And you can now obtain a genuine diamond stylus—for standard or micro-groove records—at the LOWEST PRICE EVER OFFERED!

These are the finest styli available.

The same styli are used by radio stations.

REPLACEMENTS CAN BE MADE ON NEARLY EVERY TYPE OF CARTRIDGE

ATTENTION G. E. CARTRIDGE OWNERS: Don't throw away your old model variable reluctance cartridge. The worn stylus *can be replaced with diamond* by our experts.

Here's how to get your diamond stylus replacement, which will pay for itself over and over. Just fill out the coupon below and mail it today. We will send you a special mailer in which you mail your cartridge or stylus assembly to us; we will replace with a new diamond stylus and return to you within a few days. If not completely satisfied after a 10 day trial, your money will be refunded.

Please Print

Andrew's Radio Co., 44 Warburton Ave., Yonkers 2, N. Y.

Enclosed is ☐ check ☐ money order for $14.95 for one diamond stylus replacement.

Make and model of cartridge.....

Stylus required ☐ for standard groove ☐ for micro-groove

Special radius sizes on request; no extra charge; state size.....

Name.....

Street.....

City.....Zone....State.....

heard in New York around 1100-1700; news 1345-1400. (McPheeters)

TIPG, 9.620, San Jose, Costa Rica, heard recently to 0030; announced sign-on as 0700. (McPheeters, N. Y.) Slattery, Oregon, and Smith, Ala., say sign-off is 2330, so may vary on occasion. Announces "La Voz de la Victor."

Radio Monte Carlo has *English* on Sundays at 1600-1700 on 6.035, 9.785. (Swedish DX broadcast via McPheeters, N. Y.)

"Ondas del Lago," Maracaibo, Venezuela, has been heard in Portugal on 4.800 at 1815. (Sousa)

"Radio Broadcasting Station of A and B Army Corps" is *new* call of the National Greek Army station at Larissa, Greece, operating on 6.745; has news Sundays, Tuesdays, Fridays 1535-1555. "This Is Nairobi Calling," 4.85, Kenya Colony, heard from 1300 with world news relayed from *BBC;* 1310 news from home (*BBC*); 1315 local (Nairobi) news, weather forecast; 1320 South African news from the South African Publicity Bureau; continues to 1400 *except* Wednesdays, Saturdays when runs to 1500; has time pips and closes with announcement, "until 1 p. m. tomorrow." "This is Belgrade, Death to Fascism, Liberty to the People," is announcement from Belgrade, 9.505, Yugoslavia; heard daily in England with news in Spanish around 0100, followed by news in *English* 0115; says "next English is at 1115 on 49.18 m." *Radio Bucharest,* 9.250, Roumania, now has news 1500-1530 instead former 1600-1630. Hamburg, 7.290, Germany, noted with news in German 0200; Helsinki, Finland, heard 0745 on 9.550 in parallel with 15.190, at 0800 the 9.555 channel left the air abruptly but broadcast continued on 15.190. (Pearce, England)

A new *"Voice of America"* relay station is under construction near Nicosia on Cyprus. (*Radio Australia*)

Radio Italiana, Rome, now seems to have commercials as a definite feature in the North American service. (Worris, N. Y.)

Nattugglan, Sweden, reports construction is under way on the *new* 100 kw. station at Diosd, near Budapest, Hungary, to be put into operation on April 15 of next year. Lists the s.w. stations now in operation as on 6.247 and 9.820 with 400 watts; *QRA* given as Magyar Kozponti Hirado Rt. Brody Sandor-Utca 5-7, Budapest VIII, Hungary.

Radio Tabriz, 6.090, Iran, is now on the air "early mornings" until 2330 when signs off with clock chiming eight. (*Nattugglan,* Sweden)

CE622, 6.222, Santiago, Chile, noted signing off in *English* 0010. CXA-19, 11.835, Montevideo, Uruguay, heard with *English* 1800-1830. (Cox, Delaware)

The interval signal used by the *BBC* in its Spanish transmission to Latin America is taken from the "Children's Overture" by Quilter. (Worris, N. Y.)

The next (first *annual*) edition of *World Radio Handbook,* compiled in

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0-18 VAC In, 0-14 VDC OUT, 5 AMP. **$4.25**
(Write for our cut prices on all types.)

3 MFD-4000 V. Oil Cond. new (2 for $9.00) each **4.95**

Acft Freq. Meter 350-450 cycles. Acc. 1½% **Hickok Model 59,** new **19.95**

Arc, S Rec. 3-6 MC less dial & dr (2 for $8). **4.50**

GF RU Coil Sets, Rec. & Xmtr (6 for $5) used, each **1.00**
(Nearest stock Freq. will be shipped)

Ham Rigs—Reconditioned Bargains!

150 W.—$85.00; 500 W—**$195.00;** 800 W.— Write for details and photo. **260.00**

B.C. 423 Sig. Gen. 54-106 MC Fund. Freq. Pulse Mod. for F.M.-TV & A.M. RF Tuning, near new **14.95**

Cabinets for rack panels, 19x83¼x13 deep, hinged cover, blk. crackle finish. May be stacked. New (3 for $13.00), each..... **4.95**

Insulators, 9" porcelain bowl. For entering or feed thru, new (2 for $3.00), each..... **2.00**

Hi-Volt power supply, RF type for TV etc., new, small, safe. 3-6 KV—**$14.95;** 6-10 KV **19.95**

Scope, Dumont 208B, near new..... **175.00**

Variac, 2 KW powerstat 1126L, near new.... **29.50**

B.C. 221 Freq. Meter, Calib. Book, near new **55.00**

HRO Receiver, 4 coils, power Sup. excel. cond. **95.00**

Motor, G.E. ⅓ HP, 1 PH, 1725 RPM, ½" shaft, new **14.75**

RK-34 dual HF Xmtg triode, 16W output, 4 for **1.00**

Resistor 10,000 ohms, 120 W, with mtg. hardware, Ind. boxed (3 for $1.00). Dozen.. **3.00**

Cond. FP Can 40 MFD—25V, DC Elec., 25 for **1.00**

"Trade-ins" accepted—25% with C.O.D. orders. F.O.B. Hempstead

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Please RUSH my FREE copy of "The Inside Story"

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Copenhagen, will probably be available in America by October 1. The U. S. representative is Ben E. Wilbur, 32 Whittlesey Ave., East Orange, New Jersey.

KZRC, "Voice of Cebu," at Cebu City, Philippines, is logged regularly in South Africa on 6.130 from 1600 with its "early morning" musical program; fair signal. *English* programs from Lourenco Marques, Mozambique, are weekdays 0000-0300 over CR7BE, 9.72 (*actually* 9.760) and CR7BU, 4.92; 0700-1100 over CR7BE only, and 1100-1600 over CR7BU and CR7AB (3.490). Portuguese programs are carried 0430-0630 over CR7BJ, 9.640 and at 1100-1500 over CR7BV, 4.79; *English* sessions on Sundays begin 0200 and continue to sign-off 1600. Reports of reception from all parts of the world are welcome at Box 594, Lourenco Marques, Mozambique, Port. East Africa. (Ridgeway, South Africa)

QRA of HOLA, 9.505, is P. O. Box 444, Colon, Panama; announcer says station opens 0900 and that it has a daily program at 2130 called "*America Speaks.*" (Bellington, N. Y.)

Radio Pakistan verified for Hankins, Pa., from Station Director, Pakistan Broadcasting Service, Dacca, Pakistan.

Israel will have a *new* high-powered s.w. transmitter on the air late in 1950; 14 frequencies have been allocated already for this new station—ranging from 21 to 6 mcs.; "Kol-Yisrael," Tel-Aviv, has news in *English* now at 0600-0615 and 1400-1415 on 6.820, 8.170; every first Wednesday in the month the Forces programs from 1200-1245 are presented in *English* and also are relayed over 4X4EA, 6.725, the Forces' Station; every third Wednesday in Spanish ("La Hora Latino Americano") over same stations; a further program in French is projected. (Bluman, Israel, via ISWC)

OZH, 15.165, Copenhagen, has news in *English* and musical programs 0500-0600 on Tuesdays, Thursdays, Saturdays. (ISWC)

ISWC, London, says *Radio Eireann*, Eire, is on the air daily on 17.840 at 1330-1350 and on 9.595 at 1510-1530; reports may be sent to *Radio Eireann*, % G. P. O. Dublin, Eire. A U. S. listener reports the 17.840 outlet more recently with news 1230. Several other stateside monitors have checked this channel with no results.

A verification letter received from Radio Station Pontinak, YCN-3, 8.090, Pontinak, West Borneo, stated that the transmitter is a *Philips* product with antenna output of 200 watts, phone; it has no QSL card. (McPhadden, Calif.)

DZH-5, 9.690, Manila, "The Station of the Stars," heard 0500 at good strength in New Zealand with *English* program; DZH-4, 6.000, Manila, has strong signals around 0530. (Gray, N. Z.)

Cajee, India, informs me via airmail that he knows of no short-wave broadcasting station in Tibet, but that in February he did hear AGH, Lhasa,

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Lecture Type Galvanometer, DC Galvano-Volt-Ammeter, scale 5-0-5, complete with shunts, 15" long x 14½" high x 7½" wide. Mfg'r Cenco No. 82145. NEW $74.95
BC-325 Transmitter 400 Watts A-1, 100 Watts A-2, A-3, frequency 1.5 to 18 MCS. 110-220 60 cycle. NEW $700.00
TBL-13 Navy Transmitter. With spares. NEW $400.00
Test Equipment IE-36 for SCR 522. NEW $19.95

AIRCRAFT EQUIPMENT

MN-26Y Radio Compass Receiver 150-325KC, 325-695Kc, 3.4-7.0 MCS. 28 volts, mfg'r Bendix. NEW $34.50
BC-709 Interphone Amplifier—ideal for aircraft, booster for telephone systems. NEW.. $4.25
RC-115A Marker Beacon Transmitter—Portable instrument landing system. NEW..... $95.00
BK-22E Relay. NEW.... $4.50
BC-733D Receiver Less Dynamotor. NEW $12.95
Impact Switch Operates on 10 G Kidde. NEW $2.50

ROUND PANEL METERS

10-0+6 DB	Weston 506	2½"	$4.50
0-4 RF Amps	GE	2"	4.00
0-5 RF Amps	Westinghouse	3½"	4.50
0-15 RF Amps	GE	2½"	3.75
0-300 MA DC	Simpson	2¼"	3.75
0-300 MA DC	Simpson	3½"	4.25
5-0-5 MA DC	Weston with 50MA Shunt	3½"	4.25
0-8 Amps DC	McClin.	2¼"	1.95
0-50 Amps DC	Weston	3½"	4.75
0-100AmpsDC	Hoyt	3"	5.00
0-3 Volts DC	Gruen	2½"	2.00
0-5 Kilovolt DC	0-10 MA DC	3½"	5.75

PORTABLE METERS

0-10 Amps	Weston	489	7.50
0-25 Amps	Weston	433	23.95
0-3-6-30 VAC	Weston	280	17.50
0-300 VAC	Weston	433	24.95
0-100 Amps DC	Switchboard	4" with 100 Amp Shunt	Weston 269	23.50

TUBES

2C34	$ 0.25	9003	$ 0.35
2C44	.65	9006	.25
2X2A	.55	3BP1	1.35
2X2/879	.35	5BP4	2.90
3C24	.38	5CP1	1.95
3C30	.35	5FP7	1.00
3E29	7.95	C5B	1.95
10Y	.45	CEQ-72	1.30
15E	1.50	CK-70	3.95
15R	.75	E-1148	.39
45 SPEC.	.35	HY-615	.25
316A	.35	VT-90 BRIT. Matched PAIR	5.95
371B	.80	VT-127A	2.25
450TH	18.25	1J6G	.85
750TL	43.50	2A3	.85
803	4.25	3A4	.35
805	3.75	3Q4	.55
807	1.00	6AJ5	.75
810	6.10	6C4	.25
826	.45	6H6	.40
872A	1.45	6K6	.45
957	.20	6SG7	.60
1005	.30	6SH7	.35
1616	.95	12A6	.20
1629	.28	25L6 GT.	.55
2051	.40	25Z5	.45
8012	1.30		
9001	.35		
9002	.35		

CAPACITORS

BATH TUB

		EACH	TEN
40 mfd	25 VDC	$0.30	$0.25
4 mfd	50 VDC	.35	.30
50 mfd	50 VDC	.40	.35
3X.1 mfd	400 VDC	.25	.20
2 mfd	400 VDC	.45	.40
.05 mfd	600 VDC	.20	.15
.25 mfd	600 VDC	.25	.20
.5 mfd	600 VDC	.30	.25
.1 mfd	600 VDC	.30	.25
2 mfd	600 VDC	.45	.40
.05 mfd	1000 VDC	.55	.50
2X.1 mfd	1000 VDC	.60	.55

OIL-FILLED AND GE PYRANOL

.5-.5 mfd	400 VDC	$0.35	$0.30
.1 mfd	500 VDC	.30	.25
2 mfd	600 VDC	.35	.30
4 mfd	600 VDC	.55	.50
5 mfd	600 VDC	.60	.55
6 mfd	600 VDC	.60	.60
8 mfd	600 VDC	1.00	.90
1-8 mfd	600 VDC	1.20	1.10
10 mfd	600 VDC	1.10	1.00
4 mfd	700 VDC	.65	.60
2 mfd	1000 VDC	.55	.50
.5 mfd	2000 VDC	1.10	.90
.25 mfd	3000 VDC	1.95	1.65
.5 mfd	3000 VDC	2.00	1.70
.1 mfd	7500 VDC	2.60	2.30
.1 mfd	12,000 VDC	9.50	9.00
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092B1	3000	2	Linear	½"	⅛"	Chic. Tel.	.25	.20
003P5	5000	2	Linear	⅜"	1⅞"	Wirt	.30	.25
048P1	50	25	Linear	⅜"	1⅜"	Dejur	.50	.40
N2017	100	25	Linear	⅜"	½"	IRC	.55	.45
148B2	1000	25	Linear	⅜"	1⅜"	Dejur	.55	.50
033	3000	25	Linear	⅜"	1⅜"	Dejur	.65	.55
155B1	15,000	25	Linear	½"	1"	Dejur	.70	.65
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Tibet, in the 14-megacycle band; power was 12 watts input, 12-volt power supply; signal clear but weak; presumed to be an amateur station.

A Swedish *DX*-er has heard a mysterious station called *Radio Stanitza* (or so sounds), a voice of the revolutionary Yugoslav emigrants, and giving a proclamation every night at 1500-1515 on approximately 6.870, strong signal in Sweden but jammed. (Swedish *DX* broadcast)

Leopoldville now has a monthly contest with five *World Radio Handbooks* as prizes for the five best weekly reception reports (that is, for 7 consecutive days); each month starts a new contest. (Leinbach, N. Y.)

Ken Dobeson, England, informs me via airmail that he will accept reports and non-verie complaints on Spanish transmitters at his *QRA* of BM/EABC, London, W.C. 1, England. He sends this current list of Spanish transmitters and schedules:

Radio Nacional De Espana, Madrid, 40 kw., 15.625 (announced 15.636), 1145-1220 in Spanish to South America (beamed.) (*Note*—This is not complete schedule for this outlet as I have heard it recently at 0715, and it is reported also afternoons.—K.R.B.) *Radio Nacional De Espana*, Madrid, 9.368, 40 kw., 1230 Polish; 1300 French; 1350 Roumanian; 1345 Italian; 1400 Portuguese; 1420 Russian; 1500 *English*; 1530 Spanish; 1600 Hungarian; 1615 German; 1630 Arabic; 1700 closes; 1715 in Spanish to Philippines; 1750 closes; 1800 in *English* to North America (*new transmission*); 1830 closes; 1845 in Spanish to Latin America; 2200 closes; all beamed to respective areas. *Radio Falange De Alicante*, 7.940, 1.2 kw., 0800-0930, 1400-1800. *Radio Menorca*, Mahon, Menorca, Balearic Islands, 7.542 (nominal frequency is 7.550 or 7.500); *new station*, heard in England between 1500-1700 in Spanish, bad modulation; tests and records in regular schedule. *Radio Club Tenerife*, Canary Islands, EA8AB, 7.518, 0.5 kw., 1600-1700; now in the clear; will *QSL* if *IRC* is enclosed. *La Voz De La Falange*, Madrid, 7.380, 0.2 kw. (*power to be increased to 10 kw.*), 1530 French; 1600-1830 Spanish; *QSL's* 100 per-cent by letter airmail. *Radio Seu*, Madrid, EDV10, 7.151, variable from 7.117-7.191, irregular schedule. *Radio Mediterraneo De Valencia*, 7.037, .1 kw. (*power to be increased*), 0600-0900, 1300-1700. *Radio Falange De Valiodolid*, F.E.T.1, 7.002, 1 kw., 0630-0830, 1400-1630 (Fridays to 1700 and Sundays to 1730). *Radio Nacional De Espana En Malaga*, EAJ9, 7.025, .2 kw., 1100-1800. *Radio Tetuan*, Spanish Morocco, 6.067, 1.5 kw., 0230-0300, 0830-1000, 1300-1800 (except Sunday when is scheduled 0830-1000, 1430-1800); weekdays has Arabic 1300-1430.

Dobeson adds: "Reliable sources in Madrid say that various high-powered transmitters for s.w. broadcasting are being built in Spanish radio factories for *Radio Nacional*, and the broadcasts in lists to Philippines, Americas,

U.S.S.R. will be augmented, present schedules being really 'trials.' I know of four 100 kw. transmitters ordered from *Marconi Espanola* and reports say others are being built by *Philips Ibenica.*"

Lyttle, Ontario, has received information from VE9AI in Edmonton, Alberta, operating on 9.540, that power is 200 watts, transmitter is Canadian Marconi PP-805, "Class C" PP-805 modulated. Antenna is a horizontal doublet, 50 feet high; reception reports are verified and correct *QRA* is Broadcasting Stations CJCA and VE9AI, 452 Birks Bldg., Edmonton, Alberta, Canada; verified with colorful *QSL* card, signed by T. Olsen.

The director of "La Voz de la Falange," 7.380, Madrid, *which is to increase power to 10 kw. shortly*, says the station hopes to broadcast in English daily soon; now uses only Spanish and French. He explained: "Owing to the shortage of electrical power, we have recently reduced our broadcasts, but when circumstances are normal, we will broadcast in *English* as we do in French. (Patrick, England)

Schedule for *The Happy Station Programs* produced and presented by Eddie Startz over PCJ, Hilversum, Holland, is—Sundays and Wednesdays 1030-1200, 17.77, 15.22, 6.02; 1600-1730, 11.73, 9.59, 6.02, and 2200-2330, 11.73, 9.59, 6.02. Monthly program sheet is sent free-of-charge to anyone requesting it from *Radio Nederland*, Station PCJ, P. O. Box 137, Hilversum, The Netherlands. (Patrick, England, and Day, Mass.)

Canada is now using the 13 mc. band at 0850-0920 (may be Monday through Friday only) to relay UN programs to South Africa over CKRP, 21.60; in parallel for this transmission is CKNC, 17.82.

Radio Espana Independiente seems to have improved its modulation and escaped intended jamming. (Peddle, Newfoundland) Is scheduled irregularly and on various channels—15.840, 14.657, 13.619, 11.610, 10.440 usually at 1130-1150, 1230-1250, 1330-1350, 1430-1450, 1500-1520, 1530-1550, 1600-1620, 1630-1650 (Tuesdays at dictation speed); on 15.840, 14.657, 13.619, 12.104, 11.610, 10.440 at 1700-1720, 1730-1750, 1830-1850 (Tuesdays at dictation speed); all-Spanish. Actual location of the *Espana Independiente, Estacion Pyrenaica* transmitters remains unknown, as far as I can ascertain, but it has long been widely reported that the broadcasts originate within the U.S.S.R. All frequencies seem to vary, usually within 100 kcs. to avoid jamming.

* * *

Acknowledgment

Thanks for the FB reports that have come through during the summer. As we begin the winter *DX* season, conditions should improve, and better *DX* should result. Keep your reports coming to me at 948 Stewartstown Road, Morgantown, West Virginia, U.S.A. Thanks! . . K.R.B.

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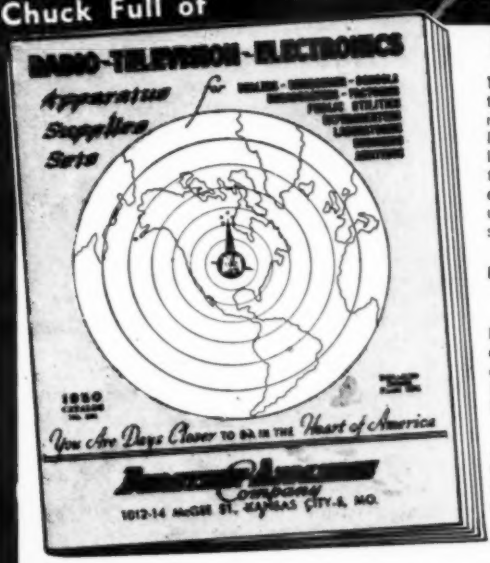

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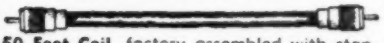

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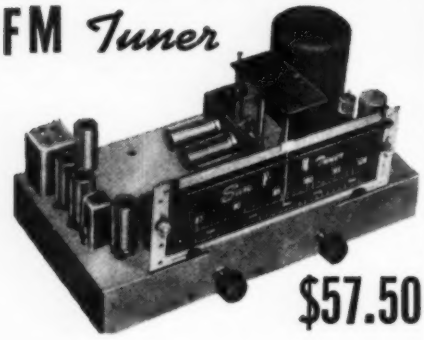

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"KEY AND ANSWERS TO NEW RADIOTELEGRAPH EXAMINATION QUESTIONS" compiled and edited by Alexander A. McKenzie. Published by *Alexander A. McKenzie,* Hackensack, New Jersey. Price $1.00. 62 pages.

This booklet for radiotelegraph first- and second-class license applicants has been based upon the FCC publication, "Study Guide and Reference Material for Commercial Radio Operator Examinations," and upon the mimeographed Supplement No. 4.

Element 1 of the examinations, questions on basic law, has been presented in full; answers to questions 233 through 296 of Element 5, basic radiotelegraph, and questions 226 through 295 of Element 6, advanced radiotelegraph, comprise the remainder of the publication.

A supplement to the ninth edition of Nilson and Hornung, "Radio Operating Questions and Answers" (reviewed in the March RADIO & TELEVISION NEWS), the booklet covers all of the changes made last April 1, including the references to radar and loran. Additional readings are suggested by the author in his introduction.

* * *

"HOWARD W. SAMS' AUTO RADIO MANUAL" published by *Howard W. Sams & Co., Inc.,* Indianapolis 1, Indiana. 300 pages. Price $4.95.

Service technicians who must frequently tackle unfamiliar auto radio jobs, and who have had to explore through numberless separate manufacturers' pamphlets for information on the circuits, will appreciate this latest Photofact publication by the Sams staff.

Formerly presented as a series of separate folders, the manual covers over 25 manufacturers' radios and provides pictures, complete specification charts, parts lists, and diagrams on each model. Each radio has four pages devoted to such description, leaving no phase of the circuit open to question.

Rather than a collection of material from available sources, data on each model was based on actual labo-

ratory analysis of the equipment, and is accurate and authoritative. The whole is uniformly presented so that one will know where, at all times, to look for specific information.

* * *

"THE A.R.R.L. ANTENNA BOOK" published by the Headquarters Staff of the *American Radio Relay League*. 288 pages. Price $1.00. Publication 15 of The Radio Amateur's Library.

This latest antenna manual is a completely rewritten edition incorporating many antenna structural discoveries made in the past ten years.

Divided into two principal parts, Chapters 1 through 5 deal with antennas and transmission lines, wave propagation, and characteristics of directive antenna systems. These comprise more or less of a text book instructing the reader on designing systems of his own to suit his needs.

Chapters 6 through 10 contain complete data on specific designs for the amateur bands, and will help those preferring not to make their own calculations in putting up a ready-made system.

The remainder of the work deals with specific mechanical features of construction and related subjects. The 831 illustrations, photographs and designs, five pages of index, and the well-informed bibliographical material make this book a valuable addition to the ham library.

—30—

PORTABLE PROBLEM SOLVED

By MILTON KALASHIAN, W1NXT

IN some of the a.c.-d.c. battery portables it is a nuisance to roll up the line cord and place it inside the cabinet where, in most cases, no room has been provided, every time the set is taken out and operated on the batteries.

A simple way to eliminate this problem is to cut the cord a few inches from where it enters the chassis and attach a miniature male plug. On the detached end of the line cord, place the miniature female plug, and whenever the portable is taken out-of-doors, all that is necessary is to unplug the line. —30—

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1F5G	.96	6AG7	1.15
1G4	.96	6AK5	1.25
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1H4G	.80	6AL7	.98
1H5GT	.60	6AQ7	.80
1H6G	1.15	6AT6	.54
1J6G	.96	6B4G	.96
1L4	.72	6B7	1.15
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1LA6	.96	6C4	.60
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1N5GT	.72	6F7	1.15
1P5GT	.80	6F8G	1.15
1Q5GT	.96	6G6G	.96
1R4	.96	6J5GT	.54
1R5	.72	6J6	.96
1S4	.85	6J7	.72
1S5	.65	6K6GT	.54
1T4	.72	6K8	.85
1T5GT	.96	6L5G	.96
1V	.80	6L6	1.28
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2A4G	1.15	6L7	1.15
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2A6	.96	6N7	.80
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6U7	.65	7E6	.72
6V6	1.15	7E7	.80
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7Z4	.72	35B5	.72
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12A6	.96	35Z4GT	.54
12A7	1.15	35Z5GT	.45
12A8	.72	36	.96
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12AT6	.60	38	.80
12BA6	.65	39/44	.96
12BE6	.65	40	.80
12C8	1.15	41	.60
12H6	.65	42	.60
12J5GT	.54	43	.60
12J7GT	.72	45	.60
12K7GT	.60	45Z3	.65
12K8	.65	45Z5GT	.65
12Q7GT	.65	46	.96
12SA7GT	.65	47	.85
12SC7	.80	48	1.40
12SF5	.65	50	1.40
12SF7	.72	50A5	.80
12SG7	.72	50B5	.72
12SH7	.80	50L6GT	.66
12SJ7	.60	50X6	.80
12SK7GT	.60	50Y6GT	.65
12SL7GT	.85	53	.96
12SN7GT	.80	56	.65
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14H7	.80	83	.96
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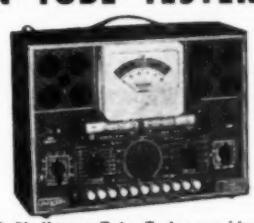

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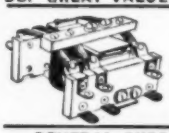

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Mac's Service Shop

(*Continued from page* 48)

tories. When times get tough—and I speak from experience during the last depression—customers are all the more likely to patronize a shop that can turn sets out cheaper because it turns them out faster. Trying to get more money out of fewer sets is the same type of foolish action that the man took when he killed the goose that laid the golden eggs; and, in time, it will end just as disastrously."

"Is that just an opinion, or can you cite an example."

"There is plenty of proof all around us. During the war, when there was a lot more service work than normal, several fellows around here—some new to the game and a few, I am sorry to say, old-timers—fell for the temptation of easy money. People were willing to pay almost any price to keep their irreplaceable sets going, and these fellows took advantage of these conditions. They charged all that the traffic would bear, and they were slovenly and lazy in their work. Instead of doing all the good work they could, they did about half of that and made up the difference in overcharges.

"Now things are rapidly changing. New sets are plentiful; competition is more keen; people are watching their nickels and dimes more carefully. As a result, we see the boys who belonged to the 'pour it on' school are beginning to fold up and go out of business. The customers who had to put up with their poor service during the war are now in a position to be more choosey. By the same token, the shops that played square with the customers when they *could* have taken advantage of them are still covered up with work."

"Okay! So you and Ben have me convinced that the way to be a success in the service business is not to see how much money you can squeeze out of each set, but to see how many sets you can squeeze into a day's work. And now let's change the subject.

"The owner of this set complained that it was noisy when tuned, and it was. Blowing out the condenser plates with the air-jet took care of that, but I noticed on the job record card that we had the same set on the same complaint last March. It doesn't seem to me that it should get dusty that soon. The condenser plates are well spaced, and they don't look very dirty. It just seems that the dust that is in there is of a kind that does an exceptionally good job of shorting out."

Mac rubbed a finger across the chassis and then rubbed the dust picked up between his finger and thumb while he looked at it closely. Next he glanced at the job card, picked up the telephone, and dialed a number.

"Mrs. Brewer," he said when the party answered, "this is Mac's Radio Service Shop. I am wondering if your little radio that we have in the shop

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D'Arsonval movement, made by leading mfr. Here is your chance to obtain a set of matched meters at a really substantial saving.

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3/4"	OD x 12' lg..	1.99	3/4" OD x 6' lg.... 1.10
7/8"	OD x 12' lg..	2.35	7/8" OD x 6' lg.... 1.32
1"	OD x 12' lg..	2.65	1" OD x 6' lg.... 1.48

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10 #15 stranded, color coded conductors. Extremely heavy and durable outer rubber covering. Overall diameter 7/8". A really superb control cable for beam use or any other application where a heavy duty multiple conductor cable may be used. **15c** Per Foot

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could possibly be used in your home in a spot that is near a steam radiator. On a shelf in the bathroom directly over a radiator, you say? And is the radiator painted with metallic paint? It is? Well, Mrs. Brewer, I suggest that you try to find some other position for the set. Not only is it bad to have your set in a spot where it is likely to become so warm, but in this case tiny particles of the metallic paint are being carried upward from your radiator by convection currents and are lodging between the plates of your tuning condensers, causing them to short out. That is what made the noise when you turned the dial. If you leave your radio there, it will have to come into the shop every few months to be cleaned. That will be fine, Mrs. Brewer; you are quite welcome."

"Oh me!" Barney groaned as Mac hung up the receiver. "Not only do I have to be honest like Ben Franklin and tell my customers how to keep their sets out of my shop; but I have to make like Sherlock Holmes and be able to feel the dust on a set and tell where it sits in the owner's home! Why didn't I take up something easy, like ditch-digging?"

-30-

A MAGIC SLATE FOR RADIO

EDWIN W. HILL, Chief Engineer, WDHL

DO YOU use up a lot of scratch paper in drawing and redrawing schematic diagrams when designing some new piece of radio apparatus? A handy aid to radio doodling is a "Magic Slate" type of drawing board, of the type sold to children under that trade name in dime and stationery stores.

This consists of a sheet of celluloid or other clear plastic, laid over a special surface. When the celluloid is written on with a stylus, the writing appears on the surface under the celluloid. When the celluloid is lifted off the surface momentarily, the writing disappears, and the "Magic Slate" is ready instantly for re-use. Thus, a new radio circuit design can be whipped into final shape without consuming reams of paper. This gadget is also one of the best things to use for a copy pad in the amateur radio station.

-30-

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• Wider Range
• Peak Reception!

This antenna rotator turns your TV antenna instantly as needed —"aims" it at the station—keeps image clear—overcomes interference and distortion! In multi-station and fringe areas Tenna-Rotor *brings in that station you couldn't get before*— increases selectivity, directivity and range!

Weather-proof enclosed electric rotor unit, (size 7" x 8") fits antenna mast—is quick and easy to install—self-lubricated for long life! Smart, plastic remote-control case plugs into 110-volt house circuit. Price $39.95. (Slightly higher west of Rockies.) Complete assembly, rotor and control case, weighs 12 lbs. End your "fixed position" antenna worries — *ask your dealer or service shop!*

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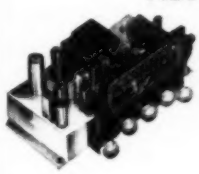
CHASSIS FOR 16" CRT
25 TUBES PLUS 4 RECTIFIERS

. . . high fidelity audio completes the picture

AUT-O-LOK TUNER



RC-8 FM-AM tuner features automatic frequency control—revolutionary FM development that *entirely eliminates* drift, simplifies tuning.

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RC-2 high-fidelity amplifier has uniform frequency response from 20 to 20,000 cycles up to 8 watts output. All units finished in polished chrome.

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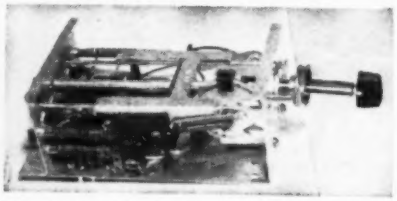


Here is a precision front-end made by well-known mfr. Covers all 13 TV channels with 8 permeability-tuned coils; coarse & fine tuning; IF freq. 21.25 Mc; uses 6AG5 RF, 6AG5 mixer & 6C4 oscillators; completely wired but not tested; with diagram, less tubes & IF coil. Some RF coils may need minor repairs, but **satisfaction guaranteed.** An outstanding value—compares with any $20 tuner. Hurry for this bargain. 3¾x2¾x7; shipping wt. 4 lbs.

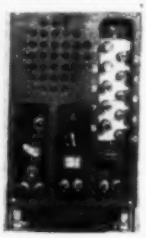
ONLY **$4.95**
In lots of 10, **$4.25**; In lots of 100 ..... **3.50**
Same as above but with perfect coils **7.95**
A few damaged but good for parts **1.95**

WIRE RECORDER MECHANISM, St. George, with recording & playback head & 78 RPM turntable; same as used in most wire recorders; records up to 1 hr. radio program, voice or direct from own phono turntable; has place to mount standard phono pickup. Furnished with ose. coil & diag. to wire 2-tube ose. to adapt unit to any radio or amplifier. 9x13x3½, 15 lb. List $75 ..... **$22.95**

VIBRATOR POWER SUPPLY PE-120 for BC-659 & BC-620; operates from 6, 12 or 24 volts, depending on vibrator; with 12 or 24 v. vibrator, battery cable & plug.

SHOPWORN **$9.95**
Used, good **7.95**
Used, fair **4.95**

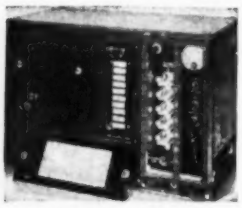
20 to 28 MC FM RECEIVER BC-603 for 11 meters; **can be tuned to 10 meters or converted to receive up to 45 Mc;** superhet, BFO squelch; 10 push buttons & manual tuning; makes 10-meter converter or IF strip for 88-108 Mc wideband FM; with all tubes, speaker, case, diagram.



UNUSED **$19.95**
USED, Excellent **17.95**
Used, Good **14.95**

CONVERSION INSTRUCTIONS FREE WITH INSTRUMENT. If purchased separately **$1.00**

DYNAMOTOR DM-34, 12 volt input, when purchased with receiver **$3.00**



20 to 28 MC FM TRANSMITTER BC-604 for 11 & 15 meters; can be operated on 10 meters by use of proper crystal; 10 channel; with all tubes, meter, diagram, case and covers; less xtals and drawer.

USED, Excellent, w/dyn **$19.95**
USED, Good, w/dyn **15.95**
USED, Good, w/o dyn **12.95**

BC-684 TRANSMITTER 27 to 38.9 MC; 30 watt 10 channel (as above); with covers, tubes, meter, diagram; less crystals and drawer.
U-1 with dynamotor **$34.95** Without dyn. . . **$32.95**
U-2 with dynamotor **29.95** Without dyn. . . **27.95**
PLUG, Cannon female fits into any of above FM sets. Does away with Mounting FT-237 ..... **$2.45**

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ELECTRONIC SUPPLIES

219-R East 1st St. Tulsa 3, Oklahoma

10-Meter Beam Antenna

(Continued from page 71)

ing with its yield point of 60,000 to 70,000 p.s.i. has an appreciable factor of safety in this application.

For 50 m.p.h. wind and ½" radial ice.

$P = .0025\ (50)^2 = 6.25$ pounds-per-square foot.

The projected area of one element with ice is $1.5/12 \times 8 = 1$ square foot.

Total load on member is 1×6.25 pounds.

$$M = \frac{6.25 \times 8 \times 12}{2} = 300 \text{ in. pounds}$$

$$\text{Stress} = MC/I = \frac{300 \times .25}{.00108} = 69{,}000$$

pounds per square inch.

The above condition produces stress which can be met by 24ST aluminum tubing; however, a very narrow margin of safety is all that can be expected. Whipping of the elements in a high wind should force much of the ice to crack and fall off; however, even with ice the array will withstand winds up to the 50 m.p.h. mark.

Due to variations in wind and icing conditions in different localities, it is advisable to consult your local weather bureau for the statistics of the severe conditions of wind and ice to be expected.

Conclusions

This first attempt at the lightweight array has been so encouraging that it is felt further experiments will prove beneficial. We are looking forward to stacking two such units one above the other and feeding the two in-phase. This may be accomplished quite easily due to the construction of the angle mounting bracket which allows the mast to slip through. In order to realize an appreciable amount of gain, it will be necessary to stack the two beams about 10 to 12 feet apart with 16 feet preferable, if possible. At any rate, the stacked beams will produce a definite lowering of the angle of radiation at any stacking with the half-wave case contributing about 4 db. to the forward gain.

Another interesting project will be to try to extend this particular type of construction to the three-element beam. No difficulties are contemplated in the elements themselves; however, the added length of boom required will no doubt require some redesigning, perhaps to larger size square tubing. It is felt that a three-element array may be constructed to stand the same wind and ice loads as this one described and still weigh under six pounds.

The views shown in the photographs give a good idea of the neat, graceful appearance of the unit and just how inconspicuous it appears when set up. Mounting of the two-meter beam or even the television array above the ten-meter unit is practical, and even desirable in most cases. —30—

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$14.95

For your beam antenna, 9001 to 1 ratio, ¾ rpm, 24 vac, 4 amp, reversible, with ¼ hpm. Completely converted. Shipping wgt. approx. 35 lbs.

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10 to 1 ratio ..... **50c ea.**

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Single 6V6 output transformers, heavy duty, glass insulated. Wgt. 1¾ lbs. 2 **$1.00**

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No. 8 ga. high voltage ignition cable. 100 ft. **$3.00**
No. 16 ga. 6 different colors ..... 100 ft. **1.50**

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Miniature tube sockets 20 **$1.00**
Drawing compass (surplus) ..... **50c ea.**

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.0001, .00025, .0005, .002, 600 volts, ceramicon condensers 20 **$1.00**

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24 vdc series motor reversible, good for intermediate duty on 110 ac . . . **85c** ea. or 2 **$1.50**

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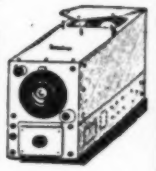

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BC 683 RECEIVER, Used Good	$24.95
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Spot Radio News

(*Continued from page* 18)

audience. Describing these programs, Poppele said: "Motion picture films on combating plant disease, controlling pests, treatment of crops, suggestions on planting, etc., which have been made but have never quite reached the fullest potential audience, would provide excellent material for the rural audience. . . . Truck farmers who are learning more and more about the value of packaging their crops for maximum profits can be taught interesting packaging methods by video. . . . It is not inconceivable that the day will come when the great mail-order houses will supplement their catalogues with daily or weekly television programs demonstrating products shown on their pages. . . . All in all, television can bring to the rural resident a new insight on living. . . . Radio was able to bring to the country dweller the finest in music, drama, and comedy, but, of course, only in the aural sense. Television now broadens that scope to a degree not dreamed of a quarter of a century ago."

FCC OPERATIONS were subjected to quite an acid inquiry during the three-day reappointment hearings of Commodore E. M. Webster, who was up for approval as FCC Commissioner for a seven-year term. Chief interrogator, Senator Charles W. Tobey, threw a barrage of questions at the Commissioner covering clear channels, motion-picture ownership of stations, abilities of the technical members of the FCC staff, research facilities of the government agency, public hearings on ownership cases, and of course, that popular topic, color TV.

The color TV query, in which an activity of *CBS* and *RCA* on patent exchanges and color-work shelving was suggested by the Senator, brought a prompt denial of such action from *CBS* President Frank Stanton. In a letter to Senator Johnson, Stanton said: "Not only is *CBS* doing nothing to hinder the development of color television, but *CBS* has done more than any other factor in the industry to foster its development. . . . Anyone familiar with the industry need only review in his mind the vigorously competitive situation between *CBS* and *RCA* in the broadcasting and recording fields over the last few years to realize how inherently unlikely dickering would be. . . . Despite the fact that *Columbia's* petition to the FCC for commercial authorization for color television was denied in 1947, we have continued experimental work in our laboratories without interruption and have made a number of significant advances and improvements in the art. These have been reported and demonstrated from time to time to members of the FCC and to organizations in the television industry."

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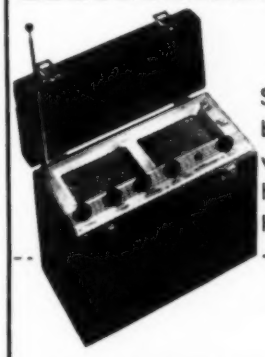

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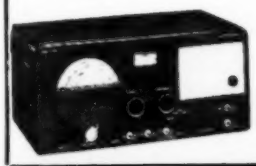

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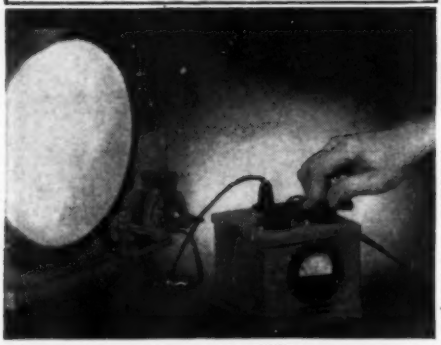

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The Commodore's answers to the Senator's quiz apparently were satisfactory since he was confirmed by a vote of 11 to 0 by the Senate group And thus the Commissioner will continue to serve in office until 1956.

A NEW METHOD OF AMPLIFYING signals at 200 to 300 megacycles in a vacuum tube was demonstrated recently by a member of the *Bell Labs*, A. V. Hollenberg. Describing his development in the *Bell Labs Record*, Hollenberg states that two streams of electrons traveling at different speeds but in the same direction and in the same space, or very close together, have been found to amplify high-frequency signals. The signal to be amplified can be impressed on the electron streams near the beginning of their travel and extracted near the end. Hollenberg reports that in the space between, the signal on the two electron streams grows because of the interaction between them, without the help of any neighboring or surrounding structure, thus affording a high gain over a broad band of frequencies.

The double-stream type of amplifier is said to differ from any other type of amplifying tube because of the absence of a metal structure. In other known amplifiers, one or more of the problems of small size of elements, small clearance between elements and electron streams, and bombardment of metal elements by electron streams inevitably raise difficulties, if the frequency is raised too much.

The tube is many wavelengths long in terms of the wave that travels on the electron streams, and each electron participates in the amplifying process during a large number of cycles of the signal, according to Hollenberg. The wavelength in the electron streams is much smaller than the free space wavelength since the electrons are traveling at much less than the speed of light. The gain, says Hollenberg, is in direct proportion to the number of wavelengths in the amplifying region. And the gain of the tube appears when both streams are on and a double-stream interaction occurs.

TRANSIT FM may soon become a feature of the majority of the buses in Chicago. A series of tests by the *Chicago Transit Authority* and the *Chicago Motor Coach Company* has proved that the system offers unusual possibilities as an entertainment medium and as a means of advertising income.

It had been expected that the system would be in operation during the summer, but the problem of feeding programs to the large number of buses operating in this city became quite a difficult one to solve. Engineers also found that two or more stations might be required to provide constant city-wide coverage. The use of two or perhaps three stations with a greater variety of programs also

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I-198-A. Frequency range 7 to 15 Mc. Multiplies into 20 and 10 meter bands. Modulated and Attenuated 115v. power supply. Easily converted to other ranges. Can be used as frequency meter.
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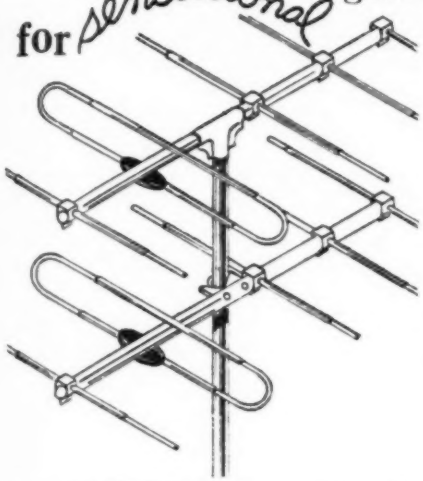

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offered an extremely interesting feature to consider.

Experts believe that the conditions are not too knotty, and it should be possible to provide a satisfactory service soon.

A NOVEL TV PATTERN has been adopted by the *BBC*. The center is occupied by a clock, and on either side are vertical bars indicating tones of white, light grey, dark grey, and black.

In place of a single tone, formerly radiated, traditional national airs are being transmitted with the pattern. These patterns are being placed on the air five minutes before program time.

IN DEEP APPRECIATION of the outstanding services of the late Harry Diamond as a Bureau of Standards scientist, dedication ceremonies were held recently at a laboratory named in his honor, the Harry Diamond Ordnance Laboratory.

Speakers at the dedication included the Honorable Charles Sawyer, Secretary of Commerce; Major General E. S. Hughes, Chief of Ordnance, Department of the Army; Rear Admiral A. G. Noble, Chief of the Bureau of Ordnance, Department of the Navy; and Major General R. C. Coupland, Director of Armament, U. S. Air Force.

Commenting on the dedication, Major General Hughes said: "It is a fitting tribute to the man who exemplified this collaborative relationship to the highest degree that the laboratory is dedicated to his name. The basis of this cooperation was established during the past year, largely through the foresight of Harry Diamond and his friends in the Army Ordnance Department."

Wires from his countless friends in industry and government poured into the Bureau, echoing the tribute of General Hughes to a brilliant engineer . . . . . L.W.

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Scope Amplifier

(*Continued from page 76*)

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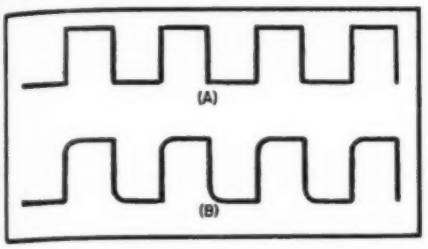

Fig. 7. (A) Typical square wave, and (B) the effect of distortion due to the loss of high-frequency components.

ator and amplifier entails the application of square waves of voltage to the input of the circuit and checking the resultant output wave on an oscilloscope. The square wave repetition frequency should be fairly high, about 20,000 cycles or more. With the oscilloscope connected to the cathode of V_{1a}, the variable condensers of the attenuator should be adjusted for best square wave response. Fig. 7 illustrates the square wave input and the result of high-frequency attenuation on the wave. It will be noted that the corners of the wave are rounded off when improper high frequency response is present. After adjusting the attenuator, the scope should be moved to the plate of V_{1b} and L_1 adjusted. Then connect the 'scope to the grid of V_2 (Fig. 2) and adjust C_6 of the coupling network. Peaking coils L_2 and L_3 may then be individually adjusted by checking response at the plates of V_2 and V_3.

With the constants given in the diagram there will be sufficient deflection to operate a five-inch scope. If more gain is desired from the output circuit, resistors R_{11} and R_{16} and coils L_2 and L_3 may be increased with a resultant reduction of high-frequency response. The amplifier has more than sufficient gain when used as the horizontal deflection circuit, but it is recommended that an additional stage be included to increase the sensitivity when used as the vertical deflection amplifier.

—30—

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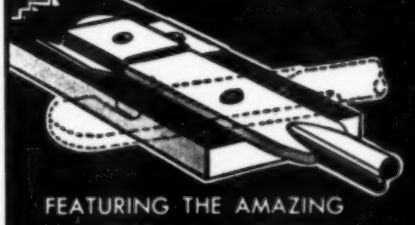

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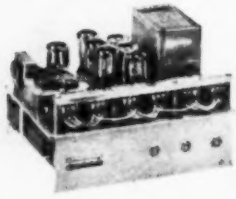

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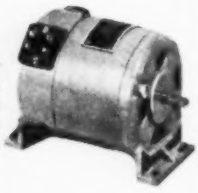

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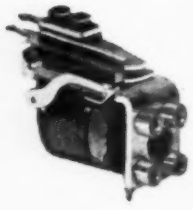

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